

# Developing 2 DoF self-stabilizer platform

Emerson Kaneda

*Centro de Digitalização de Robótica Inteligente (CeDRI)*  
*Instituto Politécnico de Bragança (IPB)*  
Bragança, Portugal  
a61103@alunos.ipb.pt

Flávio Rossini

*Departamento Acadêmico de Engenharia Eletrônica (DAELN)*  
*Universidade Tecnológica Federal do Paraná (UTFPR)*  
Campo Mourão, Brasil  
frossini@utfpr.edu.br

José Lima

*Centro de Digitalização de Robótica Inteligente (CeDRI)*  
*Instituto Politécnico de Bragança (IPB)*  
Bragança, Portugal  
jllima@ipb.pt

**Abstract**—This paper presents the design and implementation of a two degrees of freedom (2 DoF) self-stabilizer platform, intended for integration with mobile robots to support UAV landing operations. The platform leverages an ESP32 microcontroller for its core processing capabilities, interfacing with an ADXL345 IMU sensor via the I2C communication protocol to accurately detect and respond to tilt and orientation changes. The stabilization mechanism is actuated by two Nema17 stepper motors equipped with planetary reduction gearboxes, providing precise and robust control of the platform's movements. Communication between the platform and the control station is facilitated through an HC-12 wireless UART module, ensuring reliable data transmission over extended distances. This setup enables the mobile robot to maintain a stable landing platform for UAVs under various operational conditions, enhancing the overall efficiency and safety of autonomous landing procedures. Experimental results demonstrate the platform's effectiveness in dynamic environments, highlighting its potential for integration into advanced robotic systems.

**Index Terms**—Self-stabilizer platform, Control, Sensor, 2 DoF