Cable Robot Controller

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*Abstract*— Se presenta el desarrollo de un sistema integral para el control y simulación de robots paralelos suspendidos por cables. El sistema, denominado Cable Robot Controller, integra una interfaz web para visualización 3D en tiempo real, un servidor de comunicación basado en WebSocket y módulos de control para hardware físico. Se describen la arquitectura, los protocolos de comunicación, la compatibilidad con diferentes plataformas de hardware y las capacidades de simulación y operación remota. El objetivo es proporcionar una herramienta flexible y robusta para investigación y desarrollo de aplicaciones artísticas basadas en robots controlados por cables.

Keywords—component, formatting, style, styling, insert (key words)

# Introducción

Los robots paralelos suspendidos por cables constituyen una alternativa versátil para aplicaciones que requieren grandes volúmenes de trabajo y alta relación entre carga útil y masa móvil. Esto resulta especialmente importante en el campo de la robótica aplicada a instalaciones artísticas, donde se requiere habitualmente cubrir grandes espacios, con presupuestos reducidos. Si bien estos proyectos no suelen tener los altos requerimientos de precisión y repetitibilidad típicos de otras aplicaciones robóticas, su control y simulación presentan desafíos particulares debido a la redundancia, la flexibilidad de los cables y la necesidad de sistemas de seguridad confiables al exponer un robot al público. Este trabajo describe el diseño y la implementación de un sistema de control y simulación que permite operar tanto en modo virtual como con hardware real, facilitando la experimentación y el desarrollo de nuevas estrategias de control.

# Descripción del sistema

El sistema se compone de tres módulos principales:

## Interfaz Web

Desarrollada con tecnologías HTML5, CSS3 y JavaScript, implementa la visualización 3D mediante Three.js y permite la interacción directa con el modelo del robot.

## Servidor de comunicaciones

Implementado en Python, utiliza el protocolo WebSocket para la transmisión de comandos y estados entre la interfaz y el hardware.

## Módulos de firmware

Se desarrollaron *templates* para microcontroladores (Arduino y placas basadas en ESP32) y otras plataformas embebidas (Raspberry Pi), responsables de la ejecución de los comandos de control y la gestión de la seguridad física. Los módulos implementan la gestión de las comunicaciones con la interfaz de contro Webl vía WeSocket y sirven como base para el desarrollo de aplicaciones propias de cada necesidad.

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Identify applicable funding agency here. If none, delete this text box.

* Use a zero before decimal points: “0.25”, not “.25”. Use “cm3”, not “cc”. (*bullet list*)

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*a**b* 

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* The word “data” is plural, not singular.
* The subscript for the permeability of vacuum **0, and other common scientific constants, is zero with subscript formatting, not a lowercase letter “o”.
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##### Acknowledgment *(Heading 5)*

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##### References

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