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IPN Students Develop Assistive Robot for People with Disabilities

- **UPIITA students identify a key opportunity with a fully Mexican-developed system integrating multiple engineering methodologies**
- **The robot is controlled using a video game controller, allowing users to operate both the mobile base and the robotic arm with a gripper**

Students from the Instituto Politécnico Nacional (IPN) have developed an assistive robot designed to support individuals with lower-limb mobility impairments. The device features omnidirectional wheels, a robotic arm, and a gripper capable of picking up and transporting everyday items such as medications, books, and household objects.

The robot was built by students from the Unidad Profesional Interdisciplinaria en Ingeniería y Tecnologías Avanzadas (UPIITA): Arturo Ernesto Negrete Pérez, Daniel Manuel Osorio Gómez, and Erick Yuliel Zaragoza López. Its rectangular frame, constructed from V-shaped aluminum profiles, provides stability during impacts and allows it to navigate minor floor irregularities.

“We identified a valuable opportunity to contribute with a system that is 100 percent developed in Mexico, integrating methodologies learned throughout our studies along with new approaches acquired during the project to build this robot from scratch,” said Arturo Negrete.

The project aligns with national policies promoting technological development. The robot’s structure also serves as a housing unit for its electronic components. It can rotate on its own axis and move in any direction, enhancing maneuverability in indoor environments.

During development, the team collaborated with a volunteer who has congenital muscular atrophy in the legs but retains full use of his hands. Based on this, the students adapted the control system to a video game controller, allowing the user to operate both the mobile platform and the robotic arm with ease.

With guidance from UPIITA professors Jorge Fonseca Campos and Alberto Luviano Juárez, the team implemented a real-time visual monitoring system using two cameras and four ultrasonic sensors positioned at cardinal points. This setup enables users to monitor navigation and object manipulation directly from a mobile device.

"In programming, we used communication protocols such as Bluetooth, Wi-Fi connectivity, UART, and USB, along with ROS 2 technology, which enables autonomous navigation and mapping for mobile robots, precise robotic arm control, and computer vision for object recognition," explained Negrete, the project leader.

The robot incorporates four DC gear motors, a stepper motor, four servo motors, and two 12-volt rechargeable lead-acid batteries, providing approximately 12 hours of operation. It also includes three voltage regulators to ensure proper power distribution according to each component's requirements.

The final system consists of two subsystems: a mobile platform capable of navigating physical space, and a manipulator system based on a SCARA-type robotic arm with a gripper. This configuration allows the robot to grasp objects at heights ranging from 60 centimeters to one meter, based on standard table dimensions.

According to the students, Mexico currently has limited industry dedicated to developing this type of assistive technology. While similar devices can be imported, their high cost makes them inaccessible to much of the population, highlighting the importance of locally developed, affordable solutions.

For more information, visit www.ipn.mx

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