CornellEngineering
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Motor Controlling Module for Robotic Mobility Assistive Device

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Mobility-impaired people have difficulty getting up independently

- **Prevalence of Disability**: Three out of ten U.S. families have at least one member with a disability, amounting to millions of individuals with self-care challenges.
- **Caregiver Dependence:** Caregivers dedicate over a day each week to assist with mobility and daily activities, significantly reducing the independence and self-esteem of those they help due to challenges with traditional devices, privacy issues, and personal care management.
- **Aleksandr's solution**: Using differential drive with four powered mecanum wheels, include mechanisms to open/close and lift the seat with linear actuators, and close the backrest with rotary actuators.
- **Our Project goal**: We aim to build a robust motor control subsystem for the assistive device.

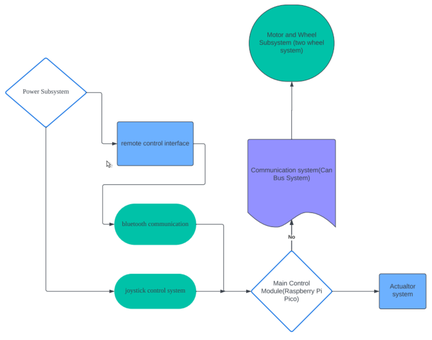


Figure 1

Joystick-Controlled Motor System Using PICO and Motor Driver

Our design project leverages the SVD48V motor driver and Raspberry Pi Pico to establish the framework for a motor control system operated via a joystick, aimed at providing intuitive and responsive control. This project will lay the foundation for motion control of robotic mobility assistive device for the disabled.

CAN bus communication for control system

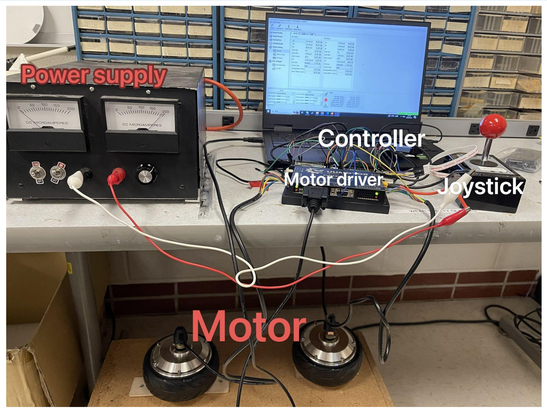


Figure 2

- Integrated the microcontroller as the central control unit.
- Connected a joystick to the microcontroller for real-time directional input.
- While the CAN communication link between the RP2040 and the motor driver is yet to be fully established, the motor operates effectively via a PC-based software tool using RS485 communication.
- Enabled configuration and precise control of the motor driver through a PC-based software tool.
- The Raspberry Pi Pico's libraries are being utilized to handle communication protocols by sending commands to the motor driver and receiving responses.
- Implemented basic data integrity checks and efficient data handling techniques to support stable and effective communication.

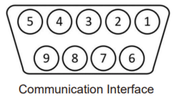
Figure 3 [1]

Figure 4 [2]. Automatic wheelchair

Why CAN?

- **Reliability in Communication:** CAN bus provides robust error detection and error-handling capabilities, ensuring reliable data transmission even in challenging environments.
- **Reduced Wiring Complexity:** By allowing multiple microcontrollers to communicate over a single or dual wire interface, CAN bus significantly reduces the complexity and weight of wiring networks.
- **Real-Time Capability:** Offers real-time capabilities ideal for control systems, facilitating timely and synchronized data exchange critical for operational efficiency.

No.	mark	name	Remark
1	RS485B	RS485 communication B signal	RS485 commun ication interface
2	RS232_TXD	RS232 send	RS232 communication interface, support RS232 DB9 male head plugs straight in. Note: RS485 will not work if an RS232 connector with flow control is used
3	RS232_RXD	RS232 receive	
4	NC	NC	NC
5	DGND	output power ground	Note: The total current limit of all external 5V power supplies is 1A
6	5V	Output power +5V	
7	RS485A	RS485 communication A signal	RS485 communication interface
8	CANH	CANH signal	CAN communication interface
9	CANL	CANL signal	



Communication Interface

Figure 5 [1]

Future work

- **CAN communication**: Establish CAN communication between microcontroller and motor driver
- **Enhanced Remote Control**: Implement advanced joystick operation to enable independent use of the mobility device, reducing caregiver dependency and increasing user privacy.
- **Automated Seating Mechanism**: Introduce motorized seat adjustments to help users move between sitting and lying positions with ease, benefiting those with limited strength or dexterity.

Reference:
[1]•https://www.uumotor.com/multi-function-rs485-can-encoder-hall-sensors-brushless-dc-dual-control-driver.html
[2]•https://www.revithaca.com/introducing-the-2023-prototyping-hardware-accelerator-cohorts/