Case Study

Students Create Wheelchair For Child with Mobility Issues

Rod Meadth

Engineering Academy Director

An Australian by birth, **Rod Meadth came to Providence School in California after serving as secondary principal at Quisqueya Christian School in Haiti.** He has served Providence as dean of students, as the founding director of the Providence Engineering Academy, and as the Principal of the Middle and Upper Schools, and most recently as the Operations Director, overseeing the development of our new Middle & Upper School Campus as Operations Director.

Mr. Meadth enjoys bringing innovative solutions to the world's problems, encouraging his students to do likewise. If he's not in his garage building the latest Engineering Academy invention, you'll find him and his wife, Brittany, out exploring Santa Barbara trails, bike paths, and beaches with their four sons.

What Was The Challenge Providence Academy Was Facing?

The primary challenge was overcoming the limitations of standard wheelchairs, which were often cumbersome and not versatile enough for various environments, particularly for children with severe mobility issues. The team set out to design a wheelchair capable of navigating different terrains, providing intuitive control mechanisms, and adapting to the user's evolving needs. This required an innovative approach, a deep understanding of the user's environment, and a commitment to iterative development and testing.

What Was The Initial Excitement Providence Academy Had For Infento?

The students were eager to use their engineering skills to make a meaningful impact. After engaging with the intended users and caregivers, they focused on creating a highly functional, tailored wheelchair. The project was an exciting opportunity to work with the Infento Pro kit, known for their modular and flexible design capabilities, allowing the students to solve real-world problems creatively.

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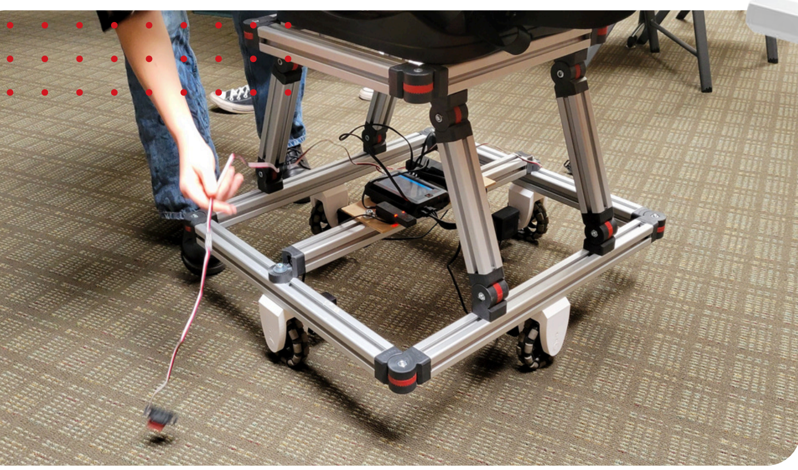
How Did Providence Academy Implement Infento?

The implementation phase was marked by collaborative problem-solving and interdisciplinary teamwork. The students divided their roles: one focused on coding and control systems, ensuring intuitive and responsive operation, while the other handled the structural design, applying mechanical engineering principles to build a robust and adaptable frame. **This effort was supported by teachers and community experts, including a physics teacher who provided insights into material strengths and dynamics, and an automotive expert who contributed to ergonomic design and safety standards.** Real-world testing, including trials by a community member of a similar age and size, was crucial for refining the design to ensure it met the highest standards of functionality and comfort.



What Was The Inventing Process Like?

The students adopted **a systematic design thinking process,** which included the following key steps:

1. Understanding the Brief: The project began with a thorough analysis of existing wheelchair models and identifying their limitations. This included other prototypes by university student engineering teams which had proved to be ineffective in practice. The team focused on areas needing improvement, such as maneuverability on uneven surfaces and user control, and keeping a relatively compact size.

2. **Ideation and Prototyping:** The students brainstormed innovative solutions and sketched their ideas, leading to the development of initial prototypes. The Infento Pro Kit allowed for flexible adjustments and modifications, making it easier to test different configurations.

3. **Testing and Iteration:** The prototypes were subjected to rigorous testing, with real-world users providing feedback. For example, the initial drivetrain struggled with transitions between floor surfaces, prompting a redesign to ensure stability. The control mechanisms were also refined to be more sensitive and user-friendly, allowing the child to operate the wheelchair with minimal effort.

Throughout these stages, the students continually refined their designs, learning to balance functionality with user comfort and safety. This iterative process ensured that the final product was not only practical but also tailored to the specific needs of the user.

How Did the Students Overcome the Challenges and Find the Solutions

Drivetrain Issues: The wheelchair initially had difficulty navigating uneven surfaces. The team redesigned the drivetrain, choosing a more robust system that, while slightly reducing maneuverability, significantly improved stability and reliability across various terrains.

Control Mechanism Refinements:
The original controls were too complex and physically demanding for the young user. After multiple rounds of testing and feedback, the team developed a new control setup with larger, more accessible buttons positioned within easy reach. This redesign made the wheelchair easier to use and greatly enhanced the user's independence.

Compatibility with Other Systems:
The Infento frame design needed to be able to seamlessly interface with two other systems: a car seat for the user and the robotic drivetrain. The modular design of the Infento system made it simple to create 3D-printed parts in-house to create these transitions in the frame and drivetrain.

Coding Integration:
The students created two modes for running the Python codebase that would control the wheelchair's ability to rotate left and right. There was an adult operated remote control mode and a simple push-button control on the wheelchair itself. The students leveraged the programming language Python to write a codebase that would integrate with the adult's remote control that would allow for rotating the wheelchair left and right. The code was set up so that the adult operator's input from the remote control would completely override the child controls with a timer that wouldn't release control to the child again until 10 seconds had gone by. This ensured that the child and adult inputs wouldn't be interfering with one another.

Positive Feedback and Impact on Students

The project highlighted the power of collaboration, involving students, teachers, and community members. It not only improved the user's mobility but also provided students with invaluable hands-on experience, emphasizing the real-world impact of engineering and the importance of user-centered design. Giving high school students the opportunity to leverage their mechanical and electrical engineering skills, their coding skills, and their design thinking skills to help make another student's life easier was powerful and fulfilling.

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Conclusion

The custom wheelchair project was a remarkable success, setting a new standard for educational initiatives in problem-solving and innovation. The experience demonstrated the potential of Infento kits in creating personalized solutions and underscored the importance of iterative testing and user feedback.

This project serves as an inspirational model, showcasing how practical education can transform lives and empower students to become future innovators and problem-solvers. **We eagerly anticipate more projects that combine creativity, teamwork, and a passion for helping others, driving positive change through practical engineering solutions.**

Interested in having Infento at your school? Contact us today!

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