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Automatic Adjustable Ergonomic Wheelchair With Enhanced Comfort For Disabled People

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Article History

Abstract

The project focuses on the design and development of an automatic adjustable ergonomic wheelchair aimed at improving comfort and usability for individuals with disabilities. The wheelchair contains advanced ergonomics features to find out the issues related to posture, pressure points and overall comfort during extended periods of usage. The key components of the wheelchair include adjustable seat height, backrest angle, armrest height and footrest position all are controlled through the latest technology for the user's convenience. The ergonomic design considers the natural alignment of the body used to minimize strain and discomfort. This contains automatic pressure relief mechanisms to reduce the risk pressure ulcers. This system utilizes sensors and a joystick to periodically adjust the seating position and airbag features and promote circulation. To enhance mobility and accessibility this wheelchair obtains smart navigation, obstacle detection systems, enabling users to need care safety in various equipped with connectivity features for remote monitoring and adjustments, facilitating personalized support and maintenance. The proposed automatic adjustable ergonomic wheelchair offers significant improvements in comfort, safety and overall quality of life for individuals with disabilities. Customizable features enhance wheelchair comfort, functionality, and adaptability to meet individual user needs.

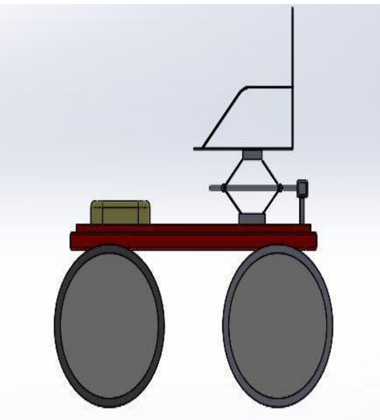
INTRODUCTION –

The integration of assistive technologies into wheelchairs plays a pivotal role in enhancing the mobility and autonomy of individuals with disabilities. Traditional wheelchairs often lack adjustable features tailored to the specific needs and preferences of users, limiting their comfort and accessibility in various environments. To address this issue, we propose the development of an automatic wheelchair height and wrist adjustment system utilizing modern electronics and mechanical components. The primary objective of this project is to design a system that allows wheelchair users to dynamically adjust both the height and wrist position of their chairs according to their individual requirements. By incorporating user-friendly controls and automated adjustments, the system aims to provide a more comfortable and personalized experience for users, thereby improving their quality of life and independence.Key components of the proposed system include an Arduino Uno microcontroller, relay modules, LCD display, joystick interface, motors for height and wrist adjustments, and associated mechanical components. The height adjustment mechanism employs a screw jack mechanism driven by a motor, while the wrist adjustment utilizes a DC motor with a worm gear mechanism. These components are integrated into the wheelchair frame to enable seamless operation and ergonomic functionality.In addition to enhancing user comfort and accessibility, the proposed system prioritizes safety considerations. Limit switches and other safety features are implemented to prevent over-adjustment and mitigate potential hazards during operation. Furthermore, the system is designed to be versatile and customizable, allowing users to tailor the adjustments to their specific needs and preferences.This project represents a significant advancement in the field of assistive technologies, offering a practical solution to address the limitations of traditional wheelchairs. By combining innovative electronics, mechanical engineering principles, and user-centered design, the automatic wheelchair height and wrist adjustment system has the potential to positively impact the lives of individuals with disabilities, empowering them to navigate their environment with greater freedom and independence.

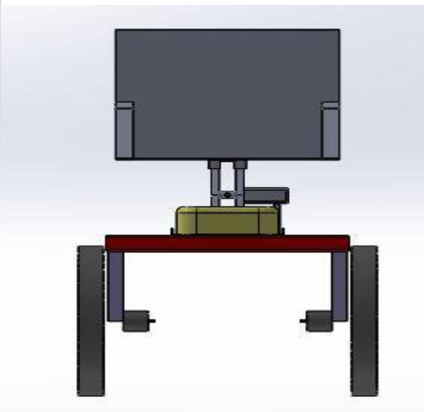
MATERIALS AND METHODS USED

The system incorporates a user interface, typically a joystick module, which allows the wheelchair user to provide input for adjusting the height and wrist position of the wheelchair. The joystick provides directional control signals indicating the desired adjustments. The system may include sensors to provide feedback on the current position and status of the wheelchair components. For example, limit switches or position sensors can be used to detect the upper and lower limits of the height adjustment mechanism, ensuring safe operation. An Arduino Uno or similar microcontroller is employed to process the user input from the joystick module and interpret the feedback from sensors. The microcontroller executes the control algorithms and generates output signals to actuate the motorized mechanisms responsible for height and wrist adjustments. The height adjustment mechanism typically consists of a motorized screw jack system. The microcontroller controls the motor's direction and speed through relay modules or motor drivers based on the user's input. Rotating the screw jack in one direction raises or lowers the wheelchair seat, providing vertical adjustment. The wrist adjustment mechanism employs a DC motor with a worm gear mechanism. The microcontroller generates PWM (Pulse Width Modulation) signals to control the speed and direction of the DC motor, allowing precise adjustment of the wheelchair's armrests or wrist supports. The system may incorporate an LCD display to provide feedback to the user regarding the current adjustments, system status, and any relevant messages or warnings. The microcontroller sends data to the LCD display for real-time updates.

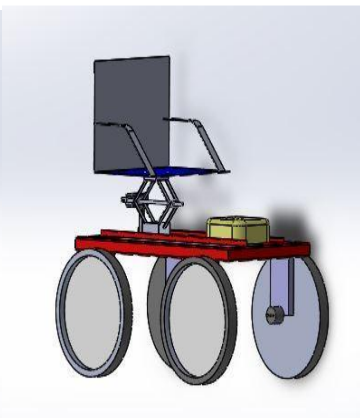
DESIGN



SIDE VIEW



BACK VIEW



FRONT VIEW

WHEELCHAIR

CIRCUIT

Geometry:
Length (L): 100 mm
Width (W): 25 mm
Thickness (T): 1 mm

Calculate the Applied
Let's assume an applied load of 10 kN (10,000 N).Applied Stress (σ) = Applied Load / Cross-Sectional Area
= 10,000 N / 25 mm^2
= 400,000 N/m^2 (or 400 MPa)

Evaluate the Stress State:
The stress state is uniaxial tensile stress along the length of the specimen, assuming the load is applied along the length.
Compare Applied Stress to Material Properties:
Given Material Properties for Mild Steel:
Yield Strength (σ_yield) = 250 MPa (hypothetical value)
Ultimate Tensile Strength (UTS) = 400 MPa (hypothetical value)
Applied Stress (400 MPa) > Yield Strength (250 MPa)
The applied stress exceeds the yield strength, indicating plastic deformation would occur.

CONCLUSION

In conclusion, the development of the automatic wheelchair height and wrist adjustment system represents a significant advancement in assistive technology, with far-reaching implications for enhancing the mobility, comfort, and independence of wheelchair users. Through the integration of modern electronics, mechanical components, and user-friendly controls, the system offers personalized adjustments tailored to individual needs and preferences. The merits of the system, including enhanced comfort, increased accessibility, and improved independence, make it well-suited for a wide range of applications across healthcare, rehabilitation, homecare, education, workplace, transportation, and leisure settings. By empowering wheelchair users to dynamically adjust their seating position and armrests, the system promotes dignity, autonomy, and inclusion in society. While the system presents certain challenges, such as cost, complexity, and reliability, ongoing research, development, and collaboration within the assistive technology community can address these issues and further optimize the system's performance, usability, and integration with existing wheelchair models. In summary, the automatic wheelchair height and wrist adjustment system exemplifies the transformative potential of technology in improving the lives of individuals with disabilities.

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