

Smart Handicap Accessible Storage Unit

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Abstract

The Smart Handicap Accessible Storage Unit will provide users with easy access to storage at an affordable cost to increase independence. The standalone unit can be implemented without modifying existing spaces, while providing an increase in storage space. A mobile phone application will be integrated into the unit for the easiest possible control.

Introduction

The Americans with Disabilities Act (ADA) mandates that public places, businesses, schools, etc. are accommodating individuals with disabilities. The Smart Handicap Accessible Storage Unit seeks to provide accessible storage for those with limited mobility at an affordable price. The ability to access storage in more areas will help the user to live more independently and increase their quality of life. The driving factor for affordability of the Smart Handicap Accessible Storage Unit is the use of a readily available modular storage system by IKEA. The PAX storage system by IKEA is not only low cost but is available in many configurations to fit the user's specific needs.

Methods and Materials

The unit is controlled using an Internet of Things application called Blynk. The application communicates with a Raspberry Pi over Wi-Fi. The Raspberry Pi works in conjunction with an Arduino Nano to accurately control the system's stepper motors which provides the lifting capabilities of the unit. Modular design makes the unit highly customizable to fit the user's individual needs.



Results

The Smart Handicap Accessible Storage unit is wirelessly controlled and capable of lifting 20Lbs (9Kg). The unit was extensively tested up to 125% of the recommended maximum load to ensure full functionality. The unit consistently displayed 33 second cycle times which met the design objectives for an effective system. Additionally, multiple conditions were tested to ensure that the safety measures in place are effective and eliminate any potential danger. ADA specified accessible ranges were used as testing criteria in place of an actual handicapped user due to the COVID-19 pandemic.

Discussion

The single shelf lift concept was chosen as the optimal design for the unit. Many factors were considered in this decision including cost, effectiveness, suitability for home use, safety, and difficulty of implementation. Rather than moving the entire cabinet to an accessible place, the single shelf lift system only transfers the desired item, minimizing the amount of work required and allowing a standard power source to be used.

Conclusions

A fully functional prototype of the Smart Handicap Accessible Storage Unit was produced by the team. Although the system was not evaluated by an actual handicapped user, thorough testing showed that the system is capable of safely and consistently placing the desired storage bins at an ADA compliant height, proving the validity of the system.

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