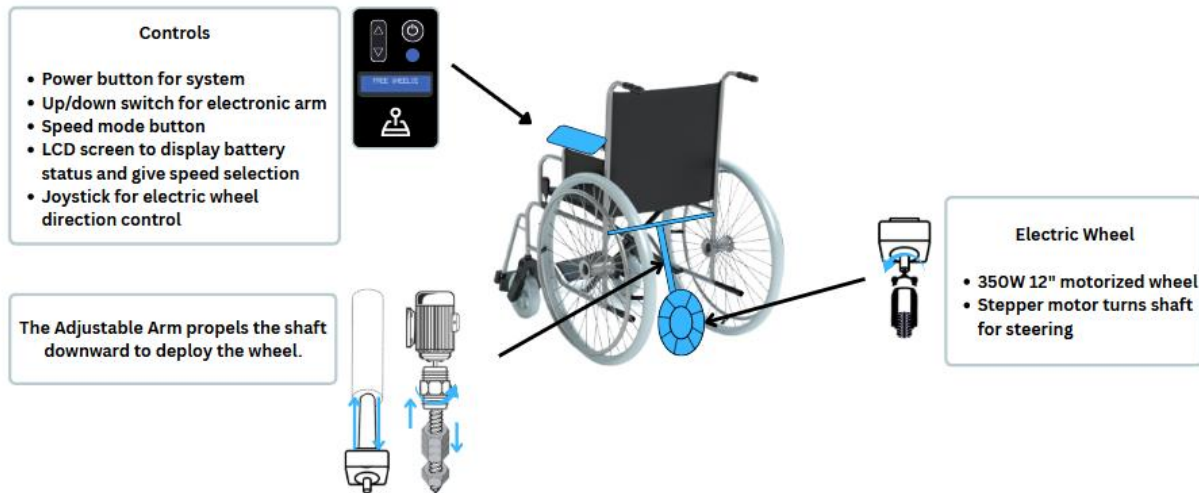


## EXECUTIVE SUMMARY

Manual wheelchair users often face physical strain from extended use, while powered alternatives are too expensive for many. These users need a low-cost, pain-reducing solution that does not require replacing their existing wheelchairs. Free Wheelie offers an attachable electric conversion kit at a fraction of the cost of an electric wheelchair. Figure 1 below shows the configuration of Free Wheelie mounted on a manual wheelchair.



**Figure 1. Free Wheelie**

Free Wheelie is a manual wheelchair conversion kit that offers users the flexibility to switch between electric and manual propulsion modes. It can propel a user weighing up to 350 lbs. at a top speed of 15 kilometers per hour. Additionally, Free Wheelie allows for intuitive installation without the use of specialized tools for manual wheelchairs without causing any obstruction during the use of the manual mode of the wheelchair. This device also complies with standards set by ISO 14971 and ISO 13485 to ensure the safety of the user and the efficacy of the device.

Select hardware and software provide optimal functionality for Free Wheelie. The Arduino Uno Rev3 is the microcontroller for the system. For electric propulsion, the design uses a 12" DNYSYSJ Hub Motor Wheel. Free Wheelie utilizes an N/C ball screw set and a STEPPERONLINE stepper motor for a smooth deployment of the hub motor. The user can deploy the wheel with a three-way rocker switch. A joystick module is included to control the rotational direction (forward/reverse) and the steering direction (left/right) of the hub motor wheel. Additionally, the steering direction is actuated by a STEPPERONLINE stepper motor. The user can alter the speed modes using a pushbutton. The device displays information to the user regarding the system status and speed modes through a 20x4 LCD.

Free Wheelie meets its goal to provide an affordable and compact option for those who use manual wheelchairs during everyday activities. Looking to the future, with some minor changes to the frame or mounting process, Free Wheelie could accommodate folding wheelchairs and different types of wheelchair frames. This would expand the target market to users with limited space, such as those with compact vehicles or who travel on public transport. These modifications would also allow users that have specially made chairs access to the Free Wheelie kit.