

ELECTRIC WHEELCHAIR UPGRADE

Project description

The aim of the project was to improve a wheelchair owned by Mr Ivo. We have decided to do the project since the main problem was too short range of the wheelchair. Two lead gel batteries were replaced with lithium ones, which have a higher capacity, better performance and longer life, a battery charger, a 24VDC to 12VDC converter, a 24VDC to 230VAC converter, a USB phone charger, a reversing camera and a heating pad were installed.

Battery

Our goal was to build a battery with a voltage of 24V and a capacity of 90Ah. This was achieved by first connecting the individual LFP cells (3.2V, 5Ah) to each other in series to give a voltage of 24V. However, as the series connection does not give any higher battery capacity, we connected sets of 8 cells 18 more times in parallel to give a capacity of 90Ah. 144 individual LFP cells were used to achieve our target.

BMS

A Battery Management System (BMS) is an electronic system used to monitor and manage the condition of batteries. It is designed to ensure optimum battery performance, reduce the risk of damage and extend battery life. The BMS monitors key battery parameters such as voltage, current, temperature, state of charge and state of discharge, and ensures that the battery is handled appropriately according to these parameters. In addition, the BMS can also inform the user of the battery status and any problems, contributing to the safety and reliability of the battery. In the wheelchair, we have modified, the BMS is installed on the top of the battery together with other important components. We also installed four temperature sensors between the cells to measure the temperature of the battery.

DC/AC inverter

A DC/AC inverter is an electronic device that inverts direct current (DC) voltage into alternating current (AC) voltage. This allows the DC voltage from a battery, solar panel or other energy source to be used to power electronic devices. In our case, we needed an inverter because we wanted a 230V socket on the wheelchair that the wheelchair user could use to charge a laptop. In addition, the socket would allow the charging of another wheelchair in case the battery of the latter was low.

Electrical installation diagram with fuses

The battery output voltage was routed through the BMS and the fuse, which was sized according to the expected power of all consumers. The fuse sizes were calculated by calculating the rated electric current, then adding 20% and selecting the fuse that was both closest to and larger than the result obtained. All the electrical parameters of the battery can be monitored using a special app on a mobile phone.

Phone holder

It was made out of a walking stick and painted in the style of the wheelchair. We attached a phone holder to the end of the stick and attached the other end to the left armrest to make it as comfortable as possible to use. The holder is also adjustable.

Reversing camera

We have made two brackets for the reversing camera. The first bracket holds the camera, which is fixed at the back on the bottom of the wheelchair. The second bracket holds the screen, which is attached to the armrest. The screen is detachable, so we used a velcro strap. A built-in DC/DC inverter powers the 12V reversing camera, and there is also a switch to switch the reversing camera on and off.

Heating pad

A removable 12V heating pad is mounted on the seat.

Comparison of battery mass, range and capacity

Two gel lead batteries with a capacity of 66Ah and a mass of 50kg were replaced by lithium batteries with a capacity of 90Ah and a mass of 29.5kg.