

# How smart can we make our wheelchairs?

**In the modern world of the Internet of Things (IoT) where might IoT apply to wheelchairs? At the October 2022 meeting of ISO TC173 Assistive Products, the Japan Assistive Products Association (JASPA) proposed that for the safety of users there should be a standard that covers this area. This article looks at where we are and where we might be going. Currently in various parts of the world wheelchairs are in use in Hospitals, Care Homes, and Airports that already make use of automatic or autonomous control systems, to transfer elderly people or people with disabilities.**

The aim is to allow the wheelchair occupant to be more independent, on the one hand, and to reduce staff costs on the other. At the simpler level, the wheelchair follows a wired pathway from A to B, while in more sophisticated applications the chair is using location software more akin to that used in your car's GPS satnav system.

## Hospital use

There's a number of hospitals in the Far East already starting to make use of autonomic wheelchairs, where the principal use is for transferring outpatients with mobility or visual impairments to their designated clinics, and then the wheelchair returns automatically to its original location. They are also used to transfer inpatients from their ward to a clinic.



**Figure 1.**  
A Whill  
autonomous  
wheelchair as used  
in hospitals and  
airports

## Care home use

It has been estimated that 11 % of a carer's time in a care home is spent moving a person from one place to another. In care homes in Japan, autonomic wheelchairs have been trialled to improve the Quality of Life of residents by allowing them to move themselves from their room to and from communal areas, as and when they want to, without the need to

control a joystick or wait for a carer. One example is the xMOVE from Pixie Dust Technologies (Fig. 2), which is a system that can be added to existing powered wheelchairs. The system uses a combination of sensors installed in the autonomous driving unit with sensors installed in the facility to get residents from one place to another.



**Figure 2.** xMOVE  
from Pixie Dust  
Technologies

## Airport use

Rather than the passenger needing to wait for a bulky golf trolley to arrive, autonomic wheelchairs provide the means to give assistance to mobility impaired passengers to reach their desired gate, and for transfer between flights. The Whill wheelchair, developed in Japan, has been trialled in Narita airport in Tokyo, and by British Airways at their terminal in JFK airport, New York. (Figs 1 and 3).



**Figure 3.**  
A Whill autonomous  
wheelchair in use at  
JFK airport, New York

## Other smart applications

For occupant operated powered wheelchairs, there is potential to apply some of the IoT aspects that might be installed in an autonomic wheelchair onto their chairs. An example might be where the chair has got into difficulties or into a dangerous situation, where a message can be sent to a carer to arrange for assistance.

Trials are in place to use autonomic wheelchairs at exhibitions where they can be programmed to attend selected stands, and in supermarkets where they can be programmed to take you to the required shelves in the correct order. The latter also leaves hands free to control the trolley.

Using IoT applications, the Whill Ci2 chair, mentioned earlier, can be controlled by an app on a phone that can bring the chair to you from where it is stored, or can be used for remote driving, as an example.

In Europe, a Turin-based company, ALBA Robot, has also been developing an autonomic wheelchair (Fig. 4). In their design they included a front panel, since they had had feedback from users in the environments described earlier that they had felt exposed, and therefore vulnerable, when in a more normal wheelchair design.



Figure 4. The ALBA Robot autonomic wheelchair

## What aspects can be applied through standardisation to improve safety?

Much work has been invested into autonomous motor vehicle design, and some of the benefits, especially around sensor technology, are being applied to autonomic wheelchairs. Relevant standardisation has already been published in ISO 13482 covering safety requirements for personal care robots, much of which will also be relevant to autonomic wheelchairs.

The key areas which the proposed autonomic wheelchairs standard will be covering initially are:

- Automatic navigation - aspects relating to localization and to sensor safety
- Obstacle detection and collision avoidance
- Detection and response to unsafe uneven, convex, and concave terrain
- Travelling speed and rate of deceleration

The first draft of the proposed standard is due later this year. The aspects listed have already been applied in the different use environments described above, and it is this experience that is being called upon for the standard.

## Concluding thoughts

We know from broad coverage in the press that there's a drastic shortage of staff to support the increasing aged population and people with disabilities. This challenge has been acknowledged for some years in Japan as there is a shortfall in the number of younger people to support the increasing number of the older generations has meant that technology to fill the gaps (such as personal care robots) has been developed. Autonomic wheelchairs have been part of the extension of these solutions in the Far East. No doubt it will not be long before we see more use of these IoT application increasing in the West to address the same problems.

## References

1. Whill: <https://whill.inc/gb/>
2. xMove: <https://pixiedusttech.com/technologies/xmove/>
3. ISO 13482:2014 Robots and Robotic Devices - Safety Requirements for Personal Care Robots
4. ALBA Robot: <https://www.alba-robot.com/>



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