Brilliance
Research of Artificial Intelligence

Volume 2, **Number** 3, November 2022
https://doi.org/10.47709/brilliance.v2i3.1547

EFFECT OF LOAD CELL LOAD CALIBRATION ON ELECTRIC WHEELCHAIR

Bobby Noval Pratama
Universitas Panca Budi, Indonesia
bobnopra@gmail.com

open access

***Corresponding Author**

Article History:
Submitted: 03-06-2022
Accepted: 06-06-2022
Published: 13-06-2022

Keywords:
load cell; load weight; wheelchair

ABSTRACT

A wheelchair is an assistive device for patients who are seriously injured or ill. Especially for people with disabilities or people who can't walk using their feet. For patients who experience total paralysis such as pain in the nerves to move the wheelchair, someone needs to push the wheelchair. If there is no one around the patient, the patient has difficulty moving the wheelchair using his hands and feet to change positions. In this research, an electric wheelchair has been created using a load cell control with body position as the driving output. Based on the test results, if the body leans forward then the wheelchair moves forward, if the body leans back then the wheelchair moves backwards, If the body leans to the left then the wheelchair moves to the left and if the body leans to the right then the wheelchair moves to the right. This study aims to analyze the ability of the load cell as the propulsion output of the electric wheelchair to the user's weight. In the results of the study, it can be seen that body weight can have a greater effect if the user's mass is getting heavier.

INTRODUCTION

The evolution of technology in various parts of the world is getting more sophisticated with the times. One of them is in the field of Health. Many health tools that help humans in carrying out their activities. An example is a wheelchair. One of the tools used is a wheelchair to move for some people, especially for people who have physical limitations (physical disabilities) [1].

Various types of wheelchairs can be found in the market. Some can be driven manually and some are driven by electricity. In manual wheelchairs, the user must move the wheelchair using the arms or muscles in the hands. This can be problematic for users with physical disabilities because they cannot move independently [2]. People with physical disabilities cannot move a wheelchair using their hands. Seeing this problem, the Electric Wheelchair was created. Electric wheelchairs can be a useful tool for those who are independent [3]. Electric wheelchairs Therefore several types of electric wheelchairs were developed. One of them is a wheelchair that is controlled by body position and a load cell as the control input.

In wheelchairs that use body position control to move and load cell controls as propulsion, there are several general components. Such as wheelchairs, DC motors, Arduino UNO, Load Cells and Battery Batteries as power sources. The load cell is a transducer that can convert the compressive force into an electrical signal [4]. Load cells are placed at several points so that input can be maximized. The analog output signal from the Load Cell is millivolt (mv) in size, so it requires an amplifier from the instrument amplification [5].

LITERATURE REVIEW

This problem is the basis for research on load cells in electric wheelchairs that use body position control to move and load cell control as the driving force on the influence of wheelchair users' weight.

A load cell or commonly called a load sensor is an electronic device in the form of a transducer device that converts the compressive force into an electrical signal. Load Cell operates on the basis of material deformation due to mechanical stress [6]. Based on the findings of Robert Hooke, the bond between mechanical stress and deformation due to the presence of strain. Strain is established on the surface of the material so that it can be measured using a strain sensor (strain gauge)[6]. The following is an image of the Load Cell shown in Figure 1.

Brilliance
Research of Artificial Intelligence

Volume 2, **Number** 3, November 2022
https://doi.org/10.47709/brilliance.v2i3.1547

Figure 1. Load Cell Design

The load cell consists of four wires in which there are two pulling wires and two pulling wires. The working principle of the load cell is that when the iron core is loaded, the resistance value of the voltage measuring device will change.

METHOD

The flowchart in this study is shown in Figure 2.

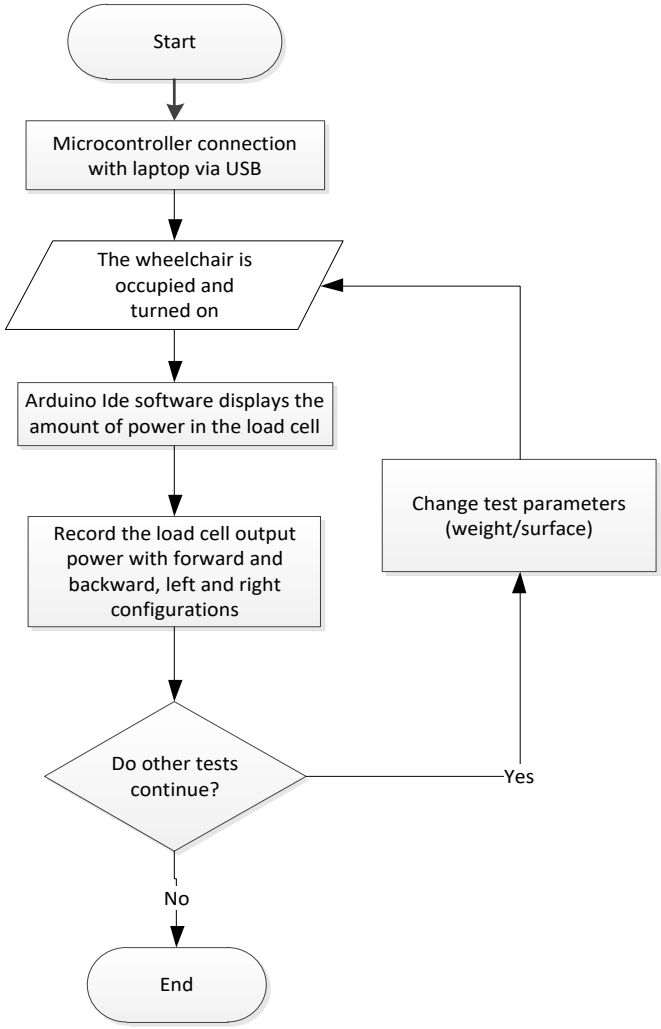

Figure 2. Research Flowchart

Brilliance
Research of Artificial Intelligence

Volume 2, **Number** 3, November 2022
https://doi.org/10.47709/brilliance.v2i3.1547

RESULT

For the left load cell calibration, the resulting data can be shown in Table 1.

Table 1. Calibration of the left load cell for the left direction with a load of 60 kg

Position	Left load cell	Right load cell	Rear load cell
Left	155	0.7	0.3
	153	0.7	0.3
	156	0.8	0.5
	154	0.8	0.4
	156	0.7	0.4
Average	154.8	0.74	0.38

It can be seen in Table 1 above that when the user's body position is pointing to the left, the reading of the value on the left load cell is greater than the value of the right and rear load cells.

For the right load cell calibration, the resulting data can be shown in Table 2.

Table 2. Calibration of the right load cell for the right direction with a load of 60 kg

Position	Left load cell	Right load cell	Rear load cell
Right	0.7	155	0.2
	0.7	153	0.3
	0.8	156	0.1
	0.8	154	0.3
	0.7	156	0.4
Average	0.74	154.8	0.26

For rear load cell calibration, the resulting data can be shown in Table 3.

Table 3. Rear load cell calibration for reverse direction with a load of 60 kg

Position	Left load cell	Right load cell	Rear load cell
Back off	0.4	0.4	190
	0.7	0.5	187
	0.5	0.7	189
	0.7	0.6	182
	0.6	0.6	191
Average	0.58	0.56	187.8

DISCUSSION

For load cell calibration for left and right positions, the resulting data can be shown in Table 4.

Table 4. Calibration of the left load cell and right load cell for the forward direction with a load of 60 kg

Position	Left load cell	Right load cell	Rear load cell
Up	155	190	0.7
	153	187	0.7
	156	189	0.8
	154	182	0.8
	156	191	0.7
Average	154.8	187.8	0.74

CONCLUSION

The conclusions that can be drawn by the authors in the research conducted are:

1. The effect of weight is very large on the performance of the load cell. If the user's weight increases, the input power to the load cell will increase.
2. The minimum speed for a wheelchair is 1.9 km/h and the maximum speed for a wheelchair is 5 km/h. This speed depends on variations in user load.
3. On a flat surface, the speed of the wheelchair experiences a constant decrease as the user's load increases. That is - 0.2 km/h at each load.

Volume 2, **Number** 3, November 2022
https://doi.org/10.47709/brilliance.v2i3.1547

4. On a non-flat surface, the speed of the wheelchair increases by + 0.4 km/h when in the reverse position, due to the greater the mass of the load, thereby increasing the speed of the wheelchair.
5. The sensitivity of the load cell will decrease as the user load increases.

REFERENCES

[1] P. Y. Reddy et al., "Eye controlled wheel chair," 2018 3rd IEEE International Conference RTEICT 2018 - Proc., pp. 1210–1213, 2018,
[2] S. Nasif and A. Khan, "Kursi roda yang dikendalikan gerakan kepala nirkabel untuk penyandang cacat," 5th IEEE Reg. 10 Humanity Technology Conference 2017, R10-HTC 2017, vol. 2018-January, pp. 156–161, 2018.
[3] R. Kristof, et al., "Robot seluler Arduino dengan kontrol gerakan Myo Armband," SACI 2019 - IEEE 13th International Computer. Informatics, Proc., pp. 294–297, 2019
[4] A. A. Pradita, et al, "Manual wheelchair design using ISO 7176-5 standard criteria," PERFORMA Vol.17, no. 1, pp. 54–60, 2018. Surabaya.
[5] P. V. Baiju, et al "Kursi Roda Cerdas untuk Orang Dengan Tantangan Fisik, "," in 2020 6th ICACCS 2020,. New Delhi.
[6] A. S. Junior dan F. Arifin, "Electric Wheelchair Prototype With Joystick And Smartphone Control," Elinvo. vol. 4, no. 1, pp. 62–68, 2019, doi: 10.21831/elinvo.v4i1.28259.
[7] M. Yusro dan A. Diamah, 2019. Sensor dan Transduser (Teori dan Aplikasi. Jakarta: Universitas Negeri Jakarta.
[8] S. Noyori et al., "Sistem Sensor Tempat Tidur dengan Beberapa Unit Sensor Berat untuk Pengukuran Akumulasi Urine di Kandung Kemih," Proc. Annu. Intermational Conference IEEE EMBS, vol. 2018-July, pp. 4375–4378, 2018.