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Design of Wheelchairs Robot Based on ATmega128 to People with Physical Disability

[1]Syahri Muharom, [2]Tukadi, [1]Tjahja Odinanto, [1]Syadidatul Fahmiah, [1]Diana Putri Permata Siwi.

[1]Electrical Engineering Department, Institut Teknologi Adhi Tama Surabaya
[2]Informatic Engineering Department, Institut Teknologi Adhi Tama Surabaya
Jl. Arief Rachman Hakim No 100, Surabaya, Indonesia

syahrimuharom@itats.ac.id

Abstract Physical disability is individual to a person having disorder movement, due to its abnormality muscular, bone structure, sick or accident. Wheelchairs are a tool to help people with physical disability. From it, the researcher proposed the creation of a wheelchair robot that was able to be used to assist in daily activities. This robot uses the Atmega128 as the primary system and the motor driver. To movement wheelchairs robot used button command, it gives commands to the Atmega128, and then the motor will drive the wheelchair movement. In the first test is motor rotation setting without load, from the data, obtained the most significant wheel rotation difference from the command is 3rpm, this different rotation because wheel slip at wheelchair and the next test with load people weight 72kg, the difference wheel rotation is 88 rpm, it because the load people at wheelchairs robot. The last test is the command button on wheelchair movement, from the tests performed get a success rate of 87.5%, this is because there was an error when testing the command to move right. From this research expected the wheelchair robot can help people with physical disabilities carrying out at daily activities a wider area.

1. Introduction

Disability is the inability body to do an activity such as ordinary people in general. Disability physic is a people with disorder movement, it's caused abnormality muscular authentic, like paralysis, or accident such as amputation of body parts. The level of disability is divided be three part, where is the first level, is the inability to do physical activity, but it still can be done with a tool. The second level is inability physic because motorists sensor has been injured and can't move the body.

Moreover, the third level is a total limitation in physical movements, and unable to control physical changes [1]. Wheelchairs are a type of tool to help people with physical disability of leg to carrying out at daily activities. At the wheelchairs having four-wheel, where two small wheels at the front of wheelchairs and two big wheels at the back [2]. From it, many disability physics used the wheelchairs to assist carrying out at daily activities [3].

Hashimoto has developed wheelchairs robot, the movement of wheelchair robot using heart rate and stress level of the user, where from this research prioritising comfort level of using a wheelchairs robot and can be weighed is 60 kg[4]. From this research, the wheelchairs robot can't reach the wider area, because, to navigated of wheelchairs robot is difficult to a user, and the wheelchairs can a movement with load is 60 kg. At the research developed by bong Keun Kim, the movement wheelchairs robot certain only at corridor and room. The study used a camera to navigate wheelchairs robot [5]. This

research prioritising navigate the system of wheelchair robot to find a room target, from it the wheelchairs robot can't reach another area.
Microcontroller Atmega128 having flash memory capacity is 128kb (kilobyte), and microcontroller 8-bit CMOS series created by Atmel, the architecture based on RISC (reduced instruction set computer). In general, the AVR having four class is Attiny, AT90sxx, AT-Mega and AT86RFxx family. To identify AVR class is the memory, peripheral and function, from architecture and instruction all the same AVR series[6]. To movement the wheelchairs robot using DC motor[6], where the DC motor converts electrical energy to be rotation mechanical energy, at general the DC motor working with hight rotation[7]. From it to robot application need gearbox to reduce hight rotation be a low rotation[8]. From the mechanism, it will increase torque[9]. A rotary encoder is a mechanic component having a function to angular position monitor, from an angular position convert be digital data pulse width, and then connected to a controller. Based on the data result from the position of angular, and processed by controller be speed data and position of the axis. Implementation of rotary encoder many used in robotics to control wheel speed left and right [10]. From the background, the researcher provides a breakthrough to created of wheelchairs robot which can be used wider area, and the researcher will build wheelchair robot with a load more than is 70 kg.

2. Design and Method

From the research, result has several methods, how to getting characteristic and analysis data. Moreover, then getting several parameters optimally wheelchairs robot. Figure 1 is a design of wheelchairs robot.

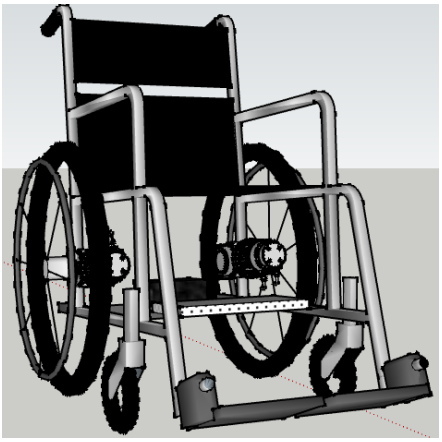

Figure 1. Design of Wheelchairs Robot

The design of wheelchairs robot, the wheelchairs having four wheels, two in front and two at the back. Moreover, the wheelchairs having two DC motor, the DC motor connected with the wheel of wheelchairs, the function of DC motor to wheel movement. To optimally the system of wheelchairs robot, the researcher makes a block system to movement wheelchairs. Moreover, figure 2 is diagram block system of wheelchairs robot.

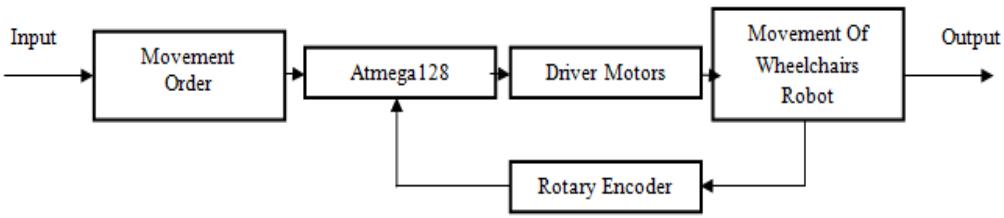

Figure 2. Diagram Block System

Block system at figure 2, the ordered movement giving a signal to Atmega128, and the Atmega128 processed it, and then providing a signal to driver motors, from driver motor giving the order to motors contained on wheelchairs, from the signal to movement of wheelchairs robot is forward, reverse, turns left and turn right. The encoder has a function to find out the wheel rotation and compared by signal order from main system Atmega128. Figure 3 is a flowchart system of wheelchairs robot

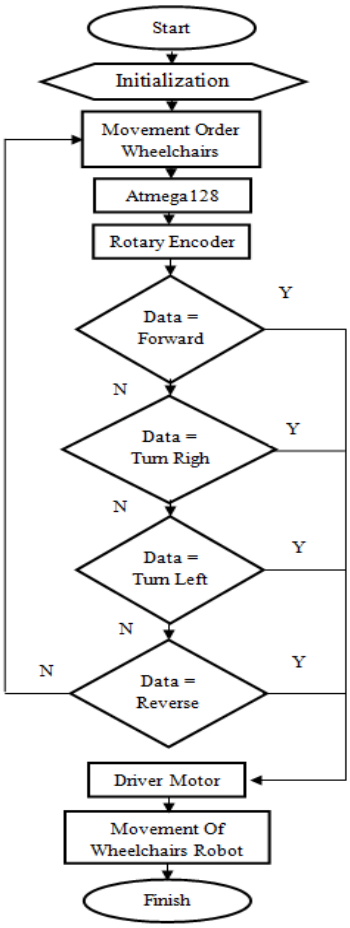

Figure 3. Flowchart System

From flowchart at figure 3, the movement of wheelchairs robot having four, forward, turn right, turn left and reverse, to movement order of wheelchairs robot using switch push button, from the flowchart system can know how to movement wheelchairs robot. Moreover, figure 3 is a design of wheelchairs robot.

3. Result and Discussion

This research having several findings, the first result is the set value of PWM (pulse width modulation) convert be rpm (rotation per minute), and then convert to be valued 0-100. Table 1 result of test rpm to wheelchairs robot without load.

Table 1. Result PWM Test Without Load

No	Input PWM (rpm)	Wheel Rotation (rpm)	Difference Rotation (rpm)
1	0	0	0
2	10	8	2
3	25	22	3
4	35	36	1
5	40	42	2
6	55	54	1
7	60	57	3
8	70	71	1
9	80	78	2
10	90	92	2
11	100	97	3

The result of this test is getting difference wheel rotation between input and output, this result influenced by several factors, among other wheel slipped. From the result, the most significant difference of wheel rotation is 3 rpm. Figure 4 is a graph of the relation between input PWM and output wheel rotation.

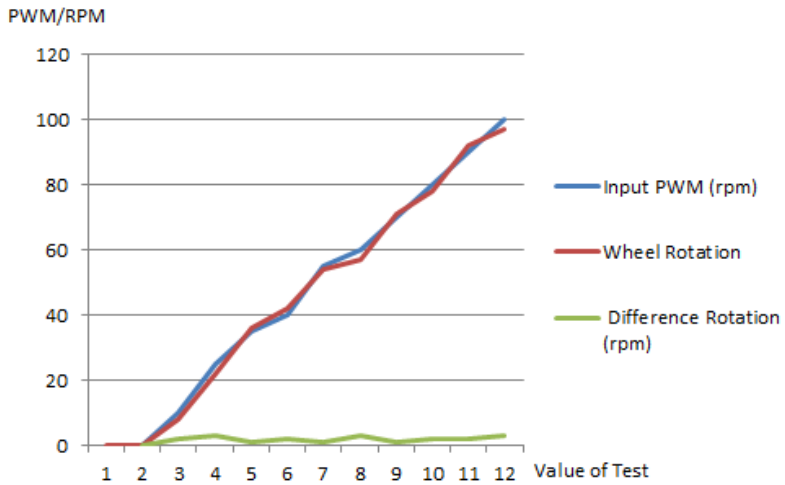

Figure 4. Graph Input Between Output Without Load Relation

The next test is the set value of PWM convert be rpm and then convert to be valued 0-100. Table 2 result of test rpm to wheelchairs robot with load weight people is 72kg.

Table 2. Result PWM Test With Load

No	Input PWM (rpm)	Wheel Rotation (rpm)	Difference Rotation (rpm)
1	0	0	0
2	10	0	10
3	25	0	25
4	35	2	33
5	40	2	38
6	55	3	52
7	60	5	55
8	70	8	69
9	80	9	71
10	90	10	80
11	100	12	88

From this test getting result difference input and output setting PWM, this result influenced by people load is 72kg. From this test the biggest difference wheel rotation is 88rpm. Figure 5 is the graph relation between input and output wheel rotation.

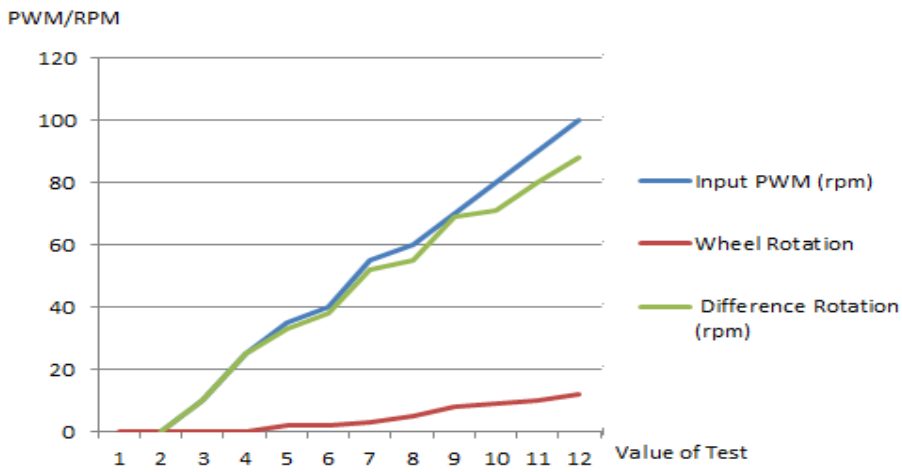

Figure 5. Graph of Relation Input Between Output With Load

The last discussion is movement order using the push button against the movement of wheelchairs robot, this test to getting a value of high success rate because it is having a function to the central navigation system. Furthermore, Table 2 is testing result of movement wheelchairs robot.

Table 3. The Result of Movement Wheelchairs Robot

No	Push Button Order	Movement of Wheelchairs Robot
1	Forward	Forward Moving
2	Turn Left	Left Moving
3	Turn Right	Little to Right Moving
4	Turn Right	Right Moving
5	Reverse	Reverse Moving

Figure 6. Wheelchairs Robot Test

The result at table 3, getting several data. From all test got one mistake, where contained at the data number 3, actually, the wheelchairs robot able to turn right is 90° degree, but the wheelchairs robot only turn right is 34° degree. It is because the system can't response order from push button to move

the wheelchairs robot. From the data result, the system has a success rate is 87,5%. Moreover, at figure 6 is wheelchairs robot test.

4. Conclusion

From the result of a testing system, several data become point observation. The first test without load getting difference wheel rotation is 3rpm; it's because of slip at the wheel of the wheelchairs robot. Moreover, the second test with load weight people is 72kg, the difference of the set value of rpm input and output is 88rpm, because of a load of people at wheelchairs robot. The last test is button command to movement wheelchairs robot, from this test getting value of success rate is 87,5%. It is expected that with this wheelchairs robot can help people with physical disabilities activities at a wider area.

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