RANCANG BANGUN KENDALI PROTOTIPE KURSI RODA LISTRIK MENGGUNAKAN SISTEM PENGENALAN UCAPAN

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Abstrak

Kata Kunci :

Abstract

Modernization of wheelchair is able to provide user to solve any limitation and problem conduct on their ability. The powered wheelchair makes the user move like normal people. One of control method of automation on its movement is determined by its rotation and velocity in the movement. Respond control of rotation and velocity has to keep on stable zone consistently base on user command. The controller has to be flexible. So, it is flexible to eliminate unconditional track the plant of the wheelchair.

The Final Project designs a system that able to support the plant of powered wheelchair. The design uses DC motor as the moving rotor of the wheelchair. The controller of the DC motor uses method of Proportional, Integral, and Derivative or known as PID. Then, the input signal uses speech of the user as its command. The block input execute with speech recognition model EasyVR. The module is integrated with the Arduino UNO for next execution process of the command.

The design of the encoder and the regulator also is in good performances and runs fine on the system. In general, speech commands have executed properly. Right and left wheels spin the same approach when given Kp = 1.140, Ki = 0.585 and Kd = 0.555 for the right DC motor and Kp = 1.227, Ki = 0.577 and Kd = 0.653 for DC motor left

Keywords : Proportional, Integral, and Derivative (PID), Motor DC, EasyVR, Arduino UNO

CHAPTER 1
INTRODUCTION

1.1 Background State

Wheelchair is a kind of first aid for humans who have a dysfunction with their motion nerve system. In more specific case, this aid is to help patients who cannot use any other aid such as buffer stick. In general, the usable value of wheelchair is to help patients who have dysfunction with their feet nerve system. In case of the dysfunction, it is clustered in three levels:

a. First Level

In this level, patients have a dysfunction with their feet motion only. So, they are able to move such as wheelchair with their own hands.

b. Second Level

In the second case, patients have a problem with both of hands and feet as the main motion system. However, they can show the direction with their hand motion, eye motion, or speech command. In this case, they need guide or helper to achieve their destination.

c. Third Level

In the third level, patients have lost their motion nerve in all. In more specific case, this kind of problem happens to stroke or paralyzed patients. They cannot move to their direction their self. Even worst, they have a problem on how to show their direction. So they really need helper or guide to help them for achieving their direction.

Along with the development of technology, market sells many kind of wheelchair today. The development itself includes manual wheelchair (traditional) till powered wheelchair which is controlled by remote or joystick. In every development contains not only benefit but also lack point. Such as joystick-powered wheelchair that looks simple and efficient. However, this kind of technology has inflexibility if it is implemented for patients who have problem with their hands nerve system.

A hypothesis said that a lot of patients or disable people want to move independent or without helper whether inside or outside of room. It is supported by survey that spread around Surabaya City for wheelchair users in the last of

2005 till the beginning of 2006, with the result that 70 % did not want helper when they did their daily life (Batan, 2006). Base on the survey, the users want to be treated as normal human being. They want to live independent. The similar survey did in February 2009 around Surabaya, one more information achieved that their wheelchair did not provide any facility which support flexible movement. It is the reason that the users could not move independently when in outdoor area (Jayantie, 2009). Some products have already produced to resolve the problem, such as the development of powered wheelchair. But, it is expensive and not flexible.

Base on the case above, researcher tried to design and implementation a prototype which hopefully solve the problem of flexibility command of powered wheelchair. The reason of the project is to make an easy and simple command to help wheelchair users. As the reference of the project, the researcher adopted masterpiece of Richard C. Simpson and Simon P. Levine which the title of "Voice Control of a Powered Wheelchair". However, the project need computer as speech commander to decode the command. The researcher has tried to re-prototype their project with other tools of speech commander. Then, the project adopted PID as the basic controller of DC motor. The PID is recommended for the plant because this method does not really need mathematical model of the plant. By using PID, hopefully the DC motor gives smooth respond toward the plant. The researcher focuses on the speech command for controlling DC Motor. As the follow up as statement above, the researcher used EasyVR as the speech commander censor.

The main problem on the research is design the prototype itself. Then, noise and interference is faced from outside the module EasyVR. It disturbs the EasyVR to decode the input data or speech command.

1.2 Problem Formulation

The problem formulations for this final project are:

1. Does the censor work for detecting and decode the speech command properly?
2. How is the design of plant to execute the commands ?
3. How does the DC Motor driver work?
4. How does the PID method planted on minimum system?

5. How does the performance analysis of the plant?

1.3 Aims and Objectives

The main aims of the prototype powered wheelchair by using speech recognition system are:

1. Analysis the censor whether or not works accurately.
2. Design the plant that is able to execute the program close to the correct setpoint.
3. Design encoder block for counting rotation speed.
4. Design regulator block for providing the stable voltage source.
5. Design the PID algorithm that will be planted on minimum system.
6. Analysis stability of plant some determined condition such as low and high interference.

Objective of the final project is:

Do design and implementation of the wheelchair prototype for controlling velocity and rotating direction of DC Motor. The plant is held using speech recognition command.

1.4 Beneficial Value of the Project:

These are the beneficial point of the project:

1. Giving a new option for industry, in specific case is biomedical industry.
2. Giving a new option of wheelchair for disable people.
3. Giving alternation by providing wheelchair with low cost budget.
4. Giving an alternative option for patients who have problem with their nerve system.
5. Giving more information, especially in control and biomedical subject.

1.5 Scope of Work:

For achieving the objectives of the final project, the researcher limits the scope of work conduct on:

1. The designed plant is just a prototype or miniature.
2. The set point of velocity is about 0.5m/s.

3. The microcontroller board in the project is Arduino UNO R3.
4. The speech recognition censor in the project is EasyVR 2.0.
5. The Speech Command divides into ‘Maju’, ‘Kanan’, ‘Kiri’, dan ‘Berhenti’.
6. The controller method of DC Motor using PID algorithm in command of “Maju” .
7. Design Blok Regulator for providing the DC source voltage.
8. Language program on the plant is C for Arduino.
9. Available software is used Arduino ID-1.0.5
10. The commands are executed in close room with low value of distortion or noise.
11. Another Parameter is delay function within input and output command.
12. Giving an order, at least 3 seconds before planed direction.

1.6 Methodology

This final project is arranged by following method:

1. Literature Studies

   This is such as investigation method based on information that is provided by book, media, expert, and so research from the others people. This method purposes to help on build fundamental theory on this final project.

2. Design and Implementation Plant

   The researcher designs prototype base on parameters which is already determined by researcher.

3. System Analysis

   Do analysis for all problems base on observation’s method with the focus of environment of the case.

4. Consultation

   The project researcher make a conversation or share an idea with advisors, lectures, and laboratory assistants who have mastered subject with scope of electronic, control, and program.

1.7 Outline of the Report

The structure of report purposes to intend for the thesis that the more organized:

CHAPTER 1: INTRODUCTION

Introduction chapter will include the background state, problem formulation, objectives, scope of work, and methodology of this Final Project.

CHAPTER 2: LITERATURE OF REVIEW

This chapter describes the basic concept of the topics for this Final Project taken from books, academic journals, and other reliable resources. In the chapter will elaborate more about EasyVR, Arduino UNO, DC Motor, and PID algorithm.

CHAPTER 3: DESIGN AND IMPLEMENTATION OF SYSTEM

This chapter describes the architecture of the system in detail, including the modelling, the block diagrams, and the flowcharts of the designed system.

CHAPTER 4: ANALYSIS AND IMPLEMENTATION

This chapter describes the implementation process the designed system, the result of the implementation, and the analysis of the system implementation.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

This is the final chapter of this Final Project. The chapter describes the final conclusion of the Final Project and the recommendation for future project.

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

From the results of the measurement and analysis that has been done on designing an electric wheelchair with speech recognition system and using the PID method, several conclusions can be drawn as follows:

1. Encoders recognize the difference of black and white properly. The maximum distance of encoders to object is placed from 0.5 cm to 5.5 cm.
2. Battery is in good condition and almost no ripple in full-charge condition. The actual value of battery is 11.35 volt.
3. Voltage regulator work toward expected design. The actual value of L7809 which is assembled in the plant is 9.20 volt. And the actual value of L7805 is 4.96 volt.
4. DC motor rotation right and left without PID was rotating unpredictable. It is because the deference value of left's and right's wheel rotation is quite wide, there are between 0.5-1 RPS.
5. DC motor rotation right and left almost executed approximately equal in rotation when added method of PID. The PID is defined for each motor DC. For both DC motor has the same set point value of 1.75 RPS. Then, by calculation and measurement it is achieved that the value of Kp =1.227, Ki=2.126, and Kd =.0.5135 for the left's DC motor. Then, for the right's DC motor is with the Kp = 1.140, Ki = 0.585 and Kd = 0.555.
6. By the testing of entire system, the tool has been run well and be able to work in accordance with its commands. If it detects "Maju" then the plant will moving forward. If it detects "Kanan" the plant will turning right. If it detects "Kiri" the plant will turning left. Last, but not the least if it detects "Berhenti" the plant will stop moving.

5.2 RECOMENDATIONS

For the developments and improvements of the overall system can be done by:

1. Using electrodes better in terms of quality and can be used continuously.
2. Using a special IC to count the sum of read data of Encoders for getting response to suit the design.
3. Using a mathematics design of plant in order to get execution properly.
4. Ultrasonic sensors can be added so that wheelchairs can automatically avoid collisions.

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