Software Aided Battery-Operated Wheel Chair

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***Abstract*— The aim of this study is to give the software consideration of a low cost battery-operated wheelchair and also to introduce the easy application of PIC programming and the specifications of a commonly used Microcontroller Microchip PIC16F877. In this paper, we have described a software application of a battery-operated wheel chair. The proposed system is meant to give simple and clear interface programming data to potential designers. The calculating values (the maximum direction values such as right-left and reverse motion) which are favorable for the user have been detected in the experiments. Herewith the user's easier control of the vehicle has been maintained. It is noted that modern motion control software may be applied to reduce such problems as grounding, shielding, susceptibility, structuring related wheelchair.**

KeyWords: Wheelchair, Motion Control, Flowchart, Microcontroller

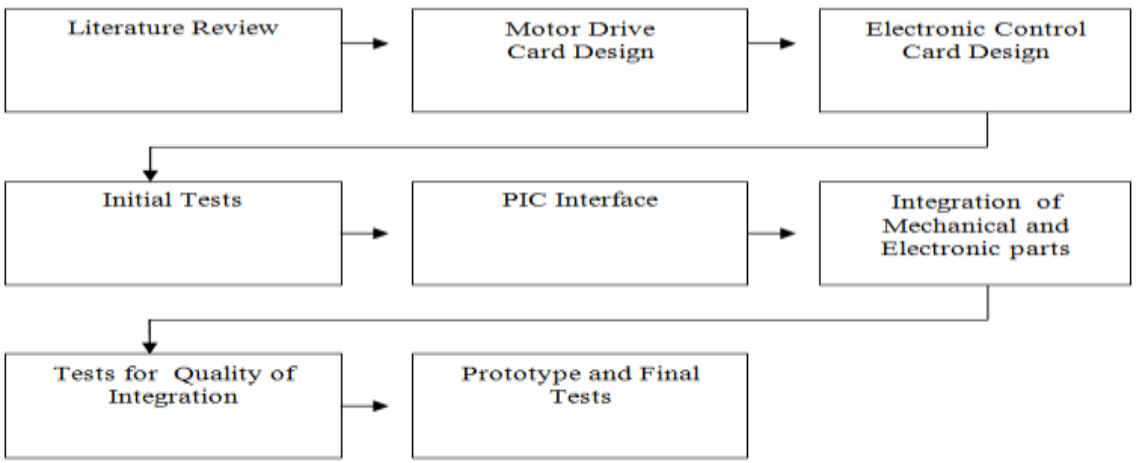
I. INTRODUCTION

Wheel chair design may be very complex in terms of stability and dynamic situations. A model has been developed for wheelchair including teering geometry, frame geomety, frame mass and distribution, factors depending on the wheelchair user and factors coming from environment (Cooper, 1993). Dynamic load analysis is extremly important for hightech design of a wheelchair. VanSickle and Cooper (1996) proposed a methodology to determine the dynamic loads acting on a wheelchair.Programming languages differ according to their implementation fields. For instance languages used in engineering are Pascal and C. Fortran; Languages for data bases are XBASE and ORACLE whereas for artificial intelligence Prolog and Lisps are used. Additionally, awk, pyton and javascript are used fas scripting programmes. For instance in Unix operating system C system is used with a ratio of 80 %; within the rest the machine language is applied. Within the programming languages, whatever the target is, the simplest methods are meant to be used. There are two types of wheelchairs, namely battery operated wheelchairs and manual ones. Battery-powered wheel chairs are useful in providing mobility especially for those who have upperlimb impairment as well as lower limb impairment. The design considerations and implementation details of a battery-powered wheel chair prototype is given by using the control unit of a wheelchair ranging from programmable logic devices to embedded personal computers (Yildirim, 2010). Ultrasonic sensors may be mounted to the wheel chair system to aid in the navigation of the wheelchair (Yoder, Baumgartner and Skaar, 1996). Wheelchair user can automatically be guided.It is accepted that the optimal control devices and wheelchair mounted robot will not be ready for potential wheelchair users in the short run. The wheelchair mounted robot with electronic equipments will make life easy for disabled people (Cherry, Cudd and Hawley, 1996).

II. SOFTWARE AND GUIDANCE FLOWCHART

Battery-Operated wheel chair guidance flowchart to reach the prototype is depicted in Fig.1. After literature review on battery-operated wheelchairs, the motor drive circuit and control circuit can be designed. Initial tests can be applied to measure the performance of both electronic cards. In case of achieving good results, the experimental model can be finalized.

Fig.1 Battery-Operated Wheel Chair Guidance Flowchart



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In order to integrate the mechanical constraction of a wheelchair with electronic control cards, PicBASIC compiled by IC-PROG programmer software can be created as an interface. Some tests can be repeated to measure the performance of the overall system in order to reach prototype.As shown in Fig. 2, the battery-operated wheel chair is mainly composed of a joystick, a control unit, motor driver unit, motor, and batteries. The wheel chair is powered by two permanent magnet dc motors, each having a power rating of 250W and a voltage rating of 24V. The system is energised by two 12V sealed lead-sulfur batteries, each with a charge capacity of 40Ah. The batteries are connected in series to obtain a 24V supply. An electromechanical relays will make the motor rotate in one direction changing operation. This operation requires careful programming in case the relay states are controlled by PIC programming. Moreover, the control process has been performed according to PIC programming. The flow chart is shown in Fig.3. Motor wheel chair consists of two forward slack wheels and two wheels connected to a motor which is natural magnetized DC motor at tail

Fig.2. Experimental Battery-Operated Wheel Chair System

Output information is obtained by evaluating the input information as shown in the flow chart.

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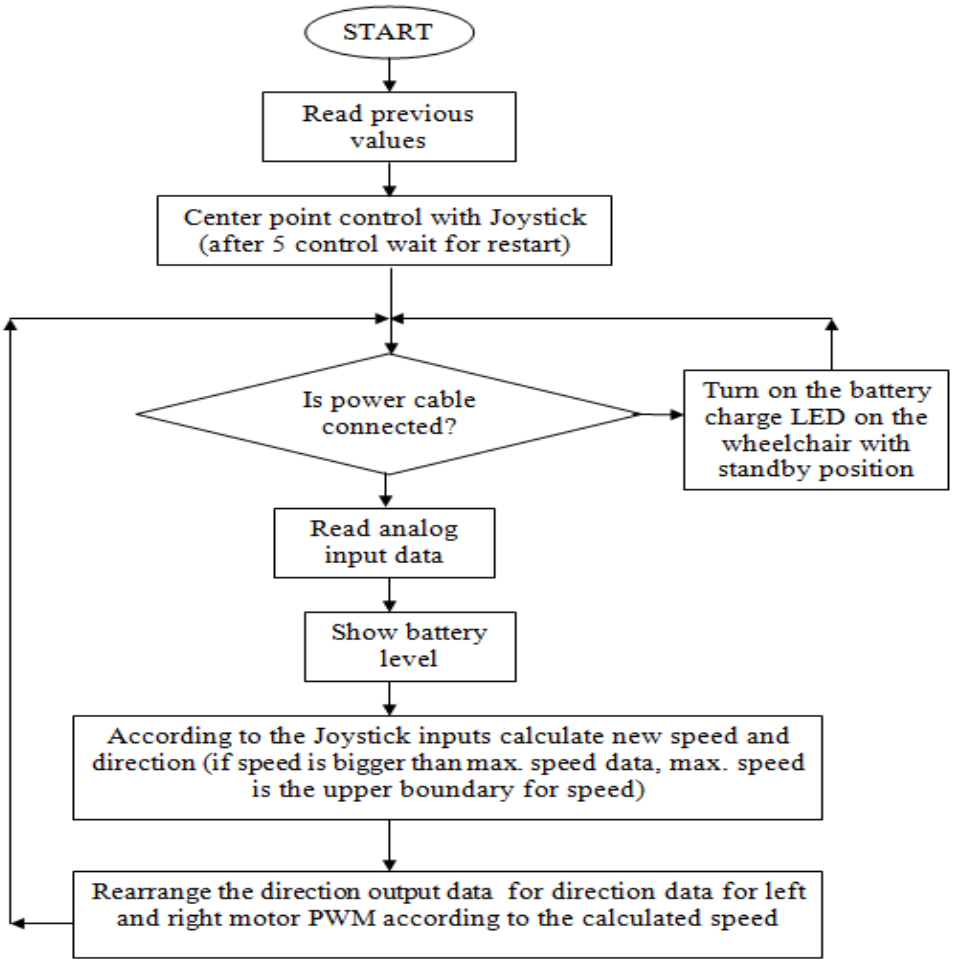

Fig.3 The Flowchart for Software

When energy is supplied for the program, firstly primary values of the device (such as maximum speed PWM, total right and total left) which were calculated before or were detected by experiment (the values such as right, left, forward and backward of the joystick) are adjusted.The joystick's position, whether in the midpoint or not is tested at the sub procedure of control. If the program does not detect the midpoint, it will indicate "fault" message in battery display led and it will not work unless it is restarted. Hereby the joystick's getting out of order in time or the motion of vehicle with an oncoming information caused by a disconnection has been inhibitted. In the further step, the program enters in an infinite circle and works in this circle until it is turned off. It checks whether the battery cord is plugged or not and if plugged, it makes the vehicle stay still and it indicates its being charged via display leds. In the next step, the analog information defined above are obtained with ADC in PIC 16F877.The analog information given by the user with a joystick is evaluated by a microcontroller. It supplies the required direction and speed output for the propulsion of the motor. PIC 16F877 is used as a microcontroller. As it is well-known, the PIC16F877 microcontroller includes 8kb of internal flash Program Memory, a large RAM area and an EEPROM. The program is designed in PicBASIC and compiled by using IC-PROG programmer software and AN 589 programmer.Input information can be listed as; (1) Joystick forward–backward information (analog), (2) Joystick right–left information (analog), (3) Maximum speed adjusting pot information (analog), (4) Battery charging plug information(digital), and (5) Battery level information (analog). On the other hand, output information can be given as; (1) Right motor forward information (digital), (2) Right motor backward information (digital), (3) Right motor PWM information (digital), (4) Left motor forward information (digital), (5) Left motor backward information (digital), (6) Left motor PWM information (digital) and (7) Battery level information 'with 5 LED lights'(digital).

III. CONCLUSION AND CONCLUDING REMARKS

In this paper, we have described a software application of a baterry-operated wheel chair. The objective of the proposed system is to give simple and clear interface programming data to potential designers of the wheelchair. The calculating values (the maximum direction values such as right-left and reverse motion) which are favorable for the user have been detected in the experiments. Herewith the user's easier controlling the vehicle has been maintained. It is noted that modern motion control software may be applied to reduce such problems as grounding, shielding, susceptibility, structuring related wheelchair. Direction and velocity control of wheelchair can be managed by means of modern software programs.

IV. REFERENCES

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