ISSN (Online) : 2394-6849

International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE)
Vol 4, Issue 4, April 2017

Joystick controlled wheelchair with automatic speed control

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***Abstract*—This paper presents a joystick controlled wheelchair with automatic speed control. This system enables the person on the wheelchair to control the motion of the wheel chair and controls speed of the motor automatically. Therefore, even if a person who knows only directions and has to travel on slopes can easily use this wheelchair as it has automatic speed control. Additionally, due to speed control on feels safe and secure sitting on it. The speed is controlled by pulse width modulation and the slope is measured using an accelerometer. Depending upon the pulse width set for a particular slope the speed of DC motors will change. This prototype mechanism can be mounted below the seat of the wheelchair and can be tested for different slopes and their speeds.**

***Index Terms*— Joystick, Accelerometer, Wheelchair**

I. INTRODUCTION

Ever in your childhood while operating a remote control car did it come to your mind that it would have been better if I would've operated it by myself like hand-driven?

Inspired from this very idea and the thought of making it useful we came up with this idea of project. JOYSTICK CONTROLLED WHEELCHAIR WITH AUTOMATIC SPEED CONTROL.

A. OBJECTIVE

The main objective of this project is to control the speed of the DC motor on basis of the slope of ground it is operating on. Like for example, as the slope increases the speed of any deice or object automatically increases and having a constant speed can risk the life of person on board on the device and increase the tendency of falling down. Thus we create a device that could control its speed automatically depending on the slope of the ground, thus decreasing the risk of a person falling.

Also, as this is a joystick controlled device there is no need of an extra person to operate the device, the person on board can do the same. This would reduce the delays in transmission due to wireless modules like Bluetooth, ZigBee etc.

II. METHODOLOGY

Considering various methods and joysticks available and the different types of methods to control DC motors, we have come up with the following plan to work with our project.

Mechanical joystick, PWM for speed control and accelerometer for angle measurement.

A. BLOCK DIAGRAM

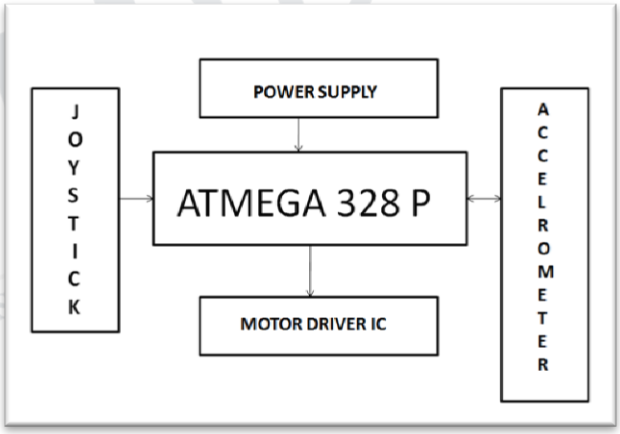

Fig -1: Block Diagram

ATMEGA328: It is a dual in line package, 28 pin, single chip microcontroller. [1]

Joystick: A joystick is used to control the movement of an object. It is a lever basically, that reports direction to the object it is controlling. Thus, it makes allows the user to make movements as per required. [2]

Motor Driver IC: A dual H-bridge integrated circuit is used here to drive the motors. Motors need high-current signal for operation. It is not possible for a controller to provide such high-current signals, thus motor driver ICs are used. They basically act as current amplifiers and provide the motor required current for operation. [3]

Accelerometer: The MPU-6050 has both accelerometer and a gyroscope in a single chip. The chip has 16-bit

ISSN (Online) : 2394-6849
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Vol 4, Issue 4, April 2017

conversion hardware for each channel and is very accurate. This chip measures x, y and z channel at the same time due to having different hardware for each. [4]

B. FLOWCHART

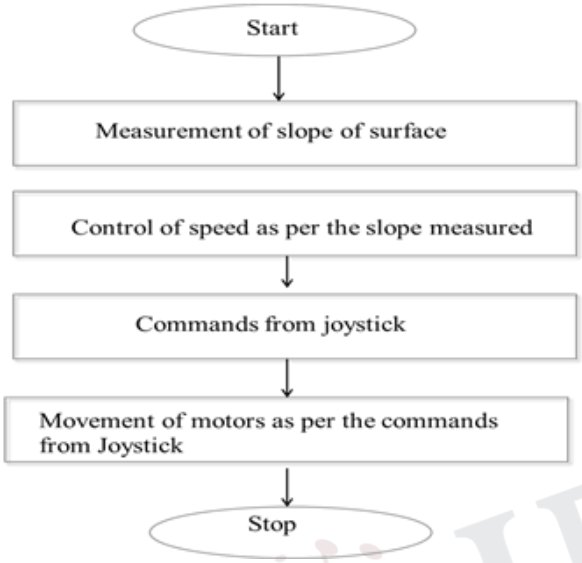

Fig -2: Flowchart

As power is supplied to the controller the first instruction is sent to the accelerometer. The accelerometer calculates the slope and sends it back to the controller. The controller then, depending upon the slope and in which range it falls decides the pulse width. The pulse width decides the speed of the motor. The motor then moves as per the instructions from the joystick. If it is a right one, motor works clockwise and the other anticlockwise, if left it's the opposite; for forward both motors rotate clockwise and for reverse both motors rotate anticlockwise. The slope of the angle and the speed of the DC motor both are displayed for the user to be assured about the change in speed.

C.Speed Control

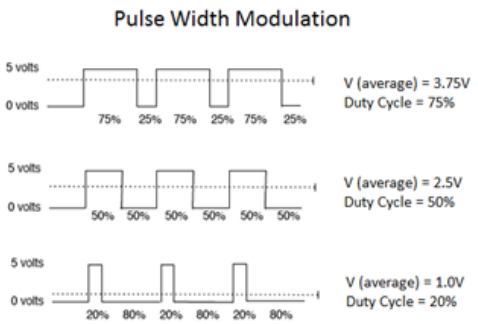

Fig -3: PWM signals

Controlling a motor using PWM is done by controlling the duty cycle. When pulse is high the motor is on and when low the motor is off. Thus, by changing the width of the pulse we can change the speed of the motor. When the pulse width or duty cycle is 50% that means we give 50% of the power supplied to the motor. When it is 80% we give 80% of the power supplied to the motor driver IC and then the speed of motors are changed accordingly. [5]

III. ADVANTAGES

A. Speed control: Due to the use of accelerometer, we can measure slope of the surface and thus keep the speed under control.
B. Safe and secure patient: When the speed is under control, a patient does not panic on slopes and thus, feels safe operating the wheelchair.
C. Self-operated: Being operated by a joystick, a person on it does not need help of any other person for its operation.
D. Easy to use: The movement of joystick is exactly how a person would want an object to move in real life. This makes our device easy to handle and use.

IV. DISADVANTAGES

A. Power Consumption: This device uses electronic components and because we haven't made a natural power source for it, power consumption is a major drawback of this device.
B. Cost: The cost of the overall product is more due to the use of microprocessors and other electronic devices.

V. APPLICATIONS

A. A wheelchair itself is an application, but to add on to this we could connect a Bluetooth module to the same and can allow its operation using a Bluetooth. For example, instead of giving the movement commands by the joystick we could create a Bluetooth application to control the movement. But, this would add delay in transmission thus, increasing danger to the life of the person on it.
B. Another addition to this could be flex sensors. A person sitting on the wheelchair could be given a band to be worn on this head. As per his head movement the wheelchair would move.

C. Also, the same kind of idea can be used in designing hi-tech games for kids. For example, in movement of mini-cars or jeeps.

VI. CONCLUSIONS

Thus, we can say that as per the movement of the joystick, the wheels move. Also, at different slopes there are different speeds. When the angle measurement as received by the accelerometer is in the range 80-90 the speed is normal, when the angle range is 7—80 the speed is reduced to 0.8 times its normal speed, when it is in the range 60-70 it reduces to 0..70 times its normal speed and so on. We have thus acquired speed control on the wheelchair depending upon the slopes.

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