International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 5 May 2022, pp: 2738-2743 www.ijaem.net ISSN: 2395-5252

Advanced Wheelchair System

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Submitted: 20-05-2022 Revised: 29-05-2022 Accepted: 01-06-2022

ABSTRACT--Freedom of mobility is a dream for every person with physical disability especially in the case of paralysis, quadriplegics. This paper focuses on the development of an advanced wheelchair for application of physically disabled persons. It helps the caregiver to avoid heavy lifting situations that put their back at risk of injury, and allow them to spend more energy at the end of the workday. The proposed concept works on the mechanical control principle which is a friendly assisting device for the physically challenged patients who can pee without the help of caregiver. This paper presents the details about design, fabricate and testing of the device. With the outcome of this paper enhancesthe knowledge in the structural design of mechanical links. It has an advantage of exit hole for human waste; thereby it becomes advanced wheel chair. The hole can be closed and opened with the help of lead screw and dc motor. Finally, in order to validate the complete proposed wheel chair, a prototype has been demonstrated and presented in this paper.

Keywords--Gesture,Arduino, Embedded,

I. INTRODUCTION

The main objective of this paper is to control a wheel using hand gesture by the meansof smartphones, for this purpose android open tools for this operation. Motor drivers are controlled via Arduino controller. In thisconfiguration Arduino app is connected viaandroidapplication using master-slave. HC-005 Bluetooth module is used which is slave and smartphone which is master.application is created. An efficient system will provide a user with good outcome so for that android platform is chosen because it provides open tools for this operation. Motor drivers are controlled via Arduino controller. In this configuration Arduino app is connected via android application using master-slave. HC-005 Bluetooth module is used which is slave and smartphone which is master.

The implementation of the smart wheel chair was broken into two halves, hardware and software. The hardware consists of the wheelchair itself and DC motors and battery. The software part is composed of programming and PCB designing. The programming was done in Arduino IDE while circuit designing and testing was performed using fritzing open source program. The hardware is designed in such a way that the wheel chair easily moves on a plane surface. The two DC motors provide necessary torque required to move flawlessly with 80kg patient. The motors are synced such that they both rotate at equal rpm to move the wheelchair in a straight line.

To move the wheelchair to the right or left their respective motor rotates the wheel and the direction is easily and safely changed by the user. The motors are powered by a single DC LINO 12-volt 26Ah rechargeable battery. The battery also provides necessary power to the electronics of the project. A single Arduino mega is the brain of the smart wheel chair. It connects the Bluetooth, the motor drive circuits, the MPU sensor and the buck boost circuits. The shaft of the motor is connected to the wheels via a strong chain sprocket mechanism. This mechanism was selected for its durability and ease of maintenance.

II. PROBLEM IDENTIFICATION

In order to invest in the user's long-term quality of life and physical wellbeing, we aim to design a system of products that approach wheelchair maintenance as a preventative measure against negative buildup. Part of this approach is aimed at preventing dangerous pressure soresfrom occurring, as this is caused by both the combination of excessive upholstery wear-and-tear and prolonged periods of sitting. By the integration of simple pressure sensors into a wheelchair at optimally predetermined locations, we can both mitigate upholstery sagging and pressure sore formation. After interviewing Lori Bernhardt, PT, ATP, from Rancho Los Amigos National Rehabilitation Center, we learned that wheelchair maintenance is crucial to the user's physical health and wellbeing but is often forgotten and delayed until the user has already sustained significant, sometimes long-lasting, physical harm. One of the

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most important aspects of a wheelchair is to maintain and support a healthy and proper posture for the user. One studyconcluded that "a properly fitted wheelchair is the single most important factor in reducing repetitive strain injuries".2 Deviation from ideal posture can lead to pressure sores, difficulty in manual propulsion from increased load on the upper limbs, discomfort and pain, and an increased risk of falls. This will clearly have a negative effect on one's quality of life, which is known to lead to a decreased participation in common daily activities and independence. 3 Among the many aspects of wheelchair configuration and fitment, the seat and backrest upholstery has a large and direct effect on the user's posture and comfort

Figure.-1:Manual Pulling of Wheelchair

III. MATERIALS AND METHODS

A. .BLOCK DIAGRAM

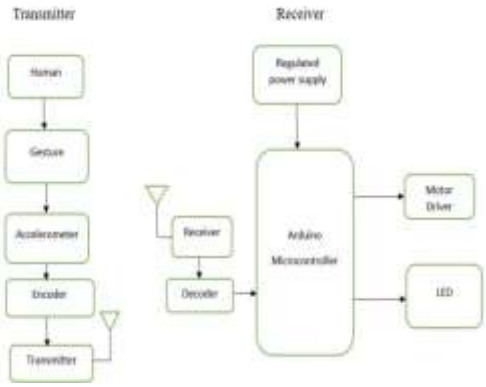

Figure-2: Block Diagram

Above diagram shows the block diagram of the proposed work "Smart Wheelchair". In this we are using Arduino Uno microcontroller. This microcontroller is connected with different modules. Here, all modules have their specific function. Smart phone unit sends the command to the bluetooth module (HC05) wirelessly. Thebluetooth unit give that command to microcontroller.

The 3 axis accelerometer and gyroscope sensor (MPU6050) gives the orientation in x, y and z axis. The 12-bit encoder IC (HT12E) converts the data into the serial stream. This converted data is transmitted to the RF Receiver module with the help of RF Transmitter module. The 12-bit Decoder IC (HT12D) converts this data into the original form. The Motor Driver IC (L293D) is connected with the microcontroller and gives command to the motor to rotate.

B. Arduino Uno

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The Arduino Uno is a microcontrollerboard based on the ATmega328P. • It has 14digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHzquartz crystal, a USB connection, a power jack, an ICSP header and a reset button. • Simplyconnect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to getstarted.

Figure-.3:Arduino Uno Board

Table-1:Specifications

Microcontroller	Atmega328
OperatingVoltage	5V
InputVoltage(Recommended)	7-12V
InputVoltageLimitation	6-12V
Digital Input/OutputPins	14
Analog Input Pins	6
ClockSpeed	16MHz
EEPROM	1KB

C. Bluetooth Specifications

A Bluetooth receiver HC 06 is used to receive signal from an Android phone. The benefitof using a Bluetooth module is that it only acts as a slave. The communication of voice and dataover a wireless network, which is also known as Wireless Personal Area Network (WPAN) andworkson a 2.4GHzband,givesthesimplicityofcommunicationwith amobile.

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WorkingTemperature	-20to+75Centigrade
ModeofOperation	Slave
DefaultBaud Rate	9600
DefaultPinCode	1234
SecurityFeatures	Authenicationand Encryption
Frequency	2.4GHzISMBand
Port	SerialPort

Table-2:Bluetooth Specifications

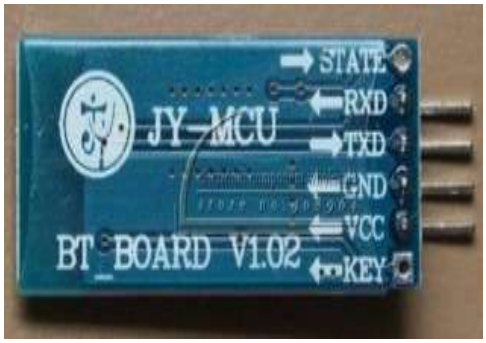

Figure-4:BluetoothModule

IV. RESULT ANALYSIS

Switch ON the Bluetooth of both of the device. If the Key is correct both the device isconnected otherwise password has to be entered again. Enter the Wheel Chair password (secondPassword)to enterthecommands.
IfboththedeviceisconnectedinputtheCommandstoop eratethesystem.Iftherequirement is forward then the forward command (f) is entered and all the dc motors aresuppliedwith12Vandmoved in forwarddirections forlinear movement.

If the requirement is reverse then the reverse command (b) is entered and all the dcmotorsaresuppliedwith12Vandmovedin backwarddirections forlinear movement.
If the requirement is to turn left then the left command (l) is entered and thus, left dcmotors are stopped and the right dc motors are supplied with 12V and the wheelchair moves inleftdirection.
If the requirement is to turn right then the right command (r) is entered and thus, right dcmotors are stopped and the left dc motors are supplied with 12V and the wheelchair moves inrightdirection.
Ifwe have tostopthewheelchair thenwemustsendtheStop(s)message.

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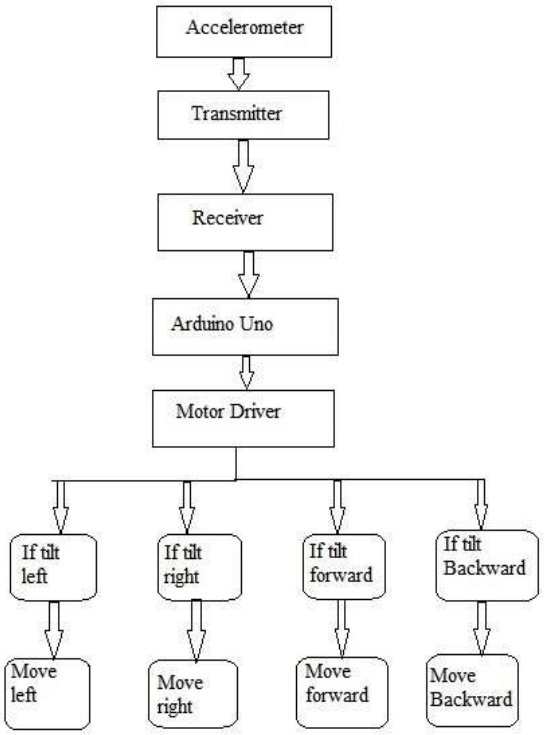

Figure-5:Working Flowchart

V. CONCLUSION AND FUTURE WORK

By using an Android app, we have successfully designed and implemented a motorized wheelchair. For most of the commands (over 95%). However, for a fool proof backup in thiscase the joystick can always be used. This project will help all the disable people who are dependent on wheelchair for their mobility. All the common man can reach out for this smart wheelchair to become independent for mobility if they hold a smart phone. Wheelchair is simple to operate and does not need any external help.

Voicerecognitionmoduleisusedtodevelopth evoicerecognitionsystem.Voicerecognitionissuesac ommandtocontrolthemovementofwheelchair.Formo vementofwheelchairMicrocontrollerAtmega328and DCmotorcircuitwerebuilt.Fornottooccurdisorder during recognize the user voice, this system works in a quiet environment. Furthermore,the pronunciations accuracy must be ensured and the word-related (voice) the users voice mustclear in short distanceonmicrophonewas essential in thisinnovation.

- Usinggearboxwecanproducehighspeedmoving wheelchair.•PWMmodulationcanalsoincreases peed.
- SolarPanelcanalsobeusedtochargethebatteryfor powersupplytothecomponentsrequiredto drivethewheelchair.
- Thewheelchair canalso includethegesturefeature tooperate thewheelchair.
- Wheelchaironlycanfunctionproperlywhenthew eightoftheloadforthissystemmustbebelow50 kilogram. Obstacleavoidance sensorsareused.

REFERENCES

[1] Zeng,M.H.AngJr.,E.Burdet,C.Guan,H.Zhang ,andC.Laugier.Controllingawheelchairindoor susing thought.IEEEIntelligentSystems,22(2):18–24, 2007.

[2] Keating D, Warwick K. Robotic trainer for powered wheelchair users. Proceedings of theIEEE International Conference on Systems, Man and Cybernetics; 1993 Oct 17–20; Le Touquet,France.Piscataway(NJ):IEEE;1993. p. 489–93.

[3] MasatoNishimori,TakeshiSaitohandRyosuke Konishi,"Voicecontrolledintelligentwheelch air,"

[4] SICE Annual Conference 2007, International onference on Instrumentation, Control andInformationTechnology,2007, pp.336–340.

[5] Moon, M. Lee, J. Chu, and M. Mun, "Wearable EMG-based HCI for Electric-PoweredWheelchair Users with Motor

Disabilities," Proc. of the 2005 IEEE Int. Conf. on Robotics andAutomation,pp. 2649-2654,2005.

[6] R. Simpson, D. Poirot, and M. F. Baxter. Evaluation of the Hephaestus smart wheelchairsystem.InIntemationalConference on RehabilitationRobotics,1999.

[7] S.I.Roumeliotis, G.S.Sukhatime, and G.A.Bekey, "Fault Detection and Identification in aMobile Robot using Multiple-Model Estimation," Proc. of 1998 IEEE Int. Conf. on Robotics andAutomation(ICRA),1998, pp.2223-2228.

[8] Bourhis G, Moumen K, Pino P, Rohmer S, Pruski A. Assisted navigation for a poweredwheelchair.SystemsEngineeringinth eServiceofHumans:ProceedingsoftheIEEEIn ternationalConferenceonSystems,Manand