FABRICATION OF AUTOMATED WHEELCHAIR FOR DESAIBLED PEOPLE

ABSTRACT:

In today's world there are many disabled persons who find it difficult to perform movements or perform daily activities. These types of persons are mainly dependent on others for their assistance. But they can become self-independent and perform some daily activities on their own with the help of assistive devices. The most widely used assistive devices are Wheelchairs. Wheelchairs is basically a chair fitted with wheels, which can help people move around who cannot walk because of illness, disability or injury. But there are many disabled people with weak limbs and joints who cannot move the wheelchair. Thus, automated wheelchair can benefit a lot to them and everyone in society. Automated wheelchairs are electric powered wheelchairs with many extra components such as handle and frame which help the user or guardian accompanying wheelchair to handle it easily and efficiently. This project is to review the current state of art of automated wheelchairs and discuss the future research in this field.

INTRODUCTION:

Wheelchairs have been used for transporting patients as well as disabled for quite a long time. Wheelchairs are driven by manual efforts, The disabled drive wheelchairs by their hands while another person is required to push patient's wheelchair. Here we propose a simple attachable extension that can be attached to a wheelchair and can transform wheelchairs into E wheelchairs that require no manual efforts. The system makes use of batteries to drive the wheelchair and no fuel-based engine which makes it ecofriendly.

The attachment uses metal rods and pipe arrangement designed to be attached to a wheelchair front rod and thus clamp on the front wheelchair rods. We then use a ball bearing integrated handle fabricated with efficient support in order to achieve directional movement. We now use a chain-based arrangement that connects motor to the wheel arrangement in order to drive the attachment. Our system uses batteries to power the motor and a switching arrangement in order to switch on and off the motor and achieve desired movement.

OBJECTIVES:

- To design and build an automated wheel chair for physically challenged persons for their independent movement.
- To design low budget automated wheelchair.
- To design a Wheelchair that works on battery.
- To reduce human effort done by physically challenged people.

METHODOLOGY:

- The attachment uses metal rods and pipe arrangement designed to be attached to a wheelchair front rod and thus clamp on the front wheelchair rods. We use a integrated handle fabricated with efficient support in order to achieve directional movement.
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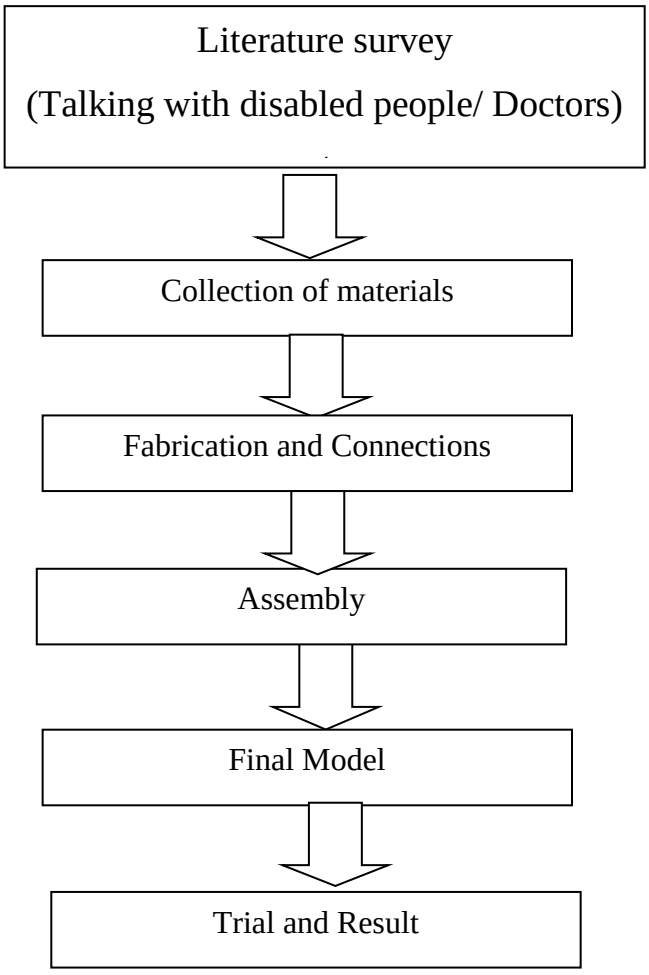
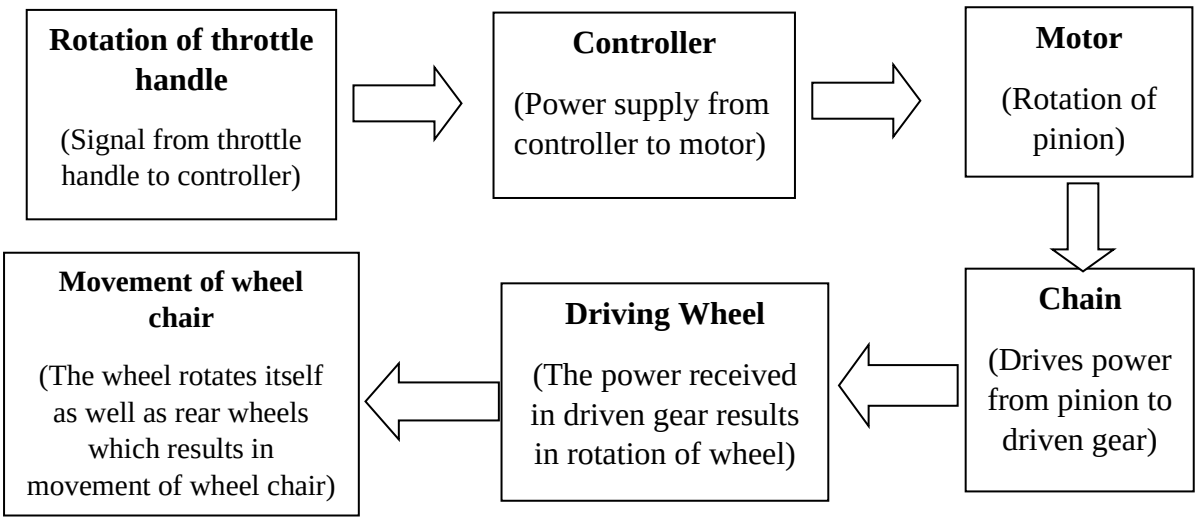


CONSTRUCTION:

- Initially a wheelchair (old or new) is connected to an automate that consist of a frame that has motor, driving wheel and handle. the chain drive is used to transmit the power from motor to the driving wheel, batteries are used to power the motor which are mounted on the wooden plank and is attached below the seat of the user. The handle is used to direct the movement of the vehicle.
- Primarily the driving wheel was prepared by attaching the driven gear to wheel with the help of free wheel welded to wheel rim.
- The handle frame consists of handle bar attached vertically to frame
- The wheel is attached to handle with the help of shaft over which the wheel rotates the wheel is driven with the help of chain.
- The motor is mounted just above front wheel and is fixed in a plate which is again welded to the frame with help of metal plate.
- The handle contains break levers and throttle handle which are further connected to controller.
- The batteries are used as power source which are mounter below the seat and are connected directly to controller

WORKING PROCEDURE :

- The motor power supply is switched on by using the key
- When the throttle handle is rotated, the signal is sent to controller.
- The controller supplies power to motor ,which results in rotation of pinion.
- The power transmitted by motor reaches the driven gear and further to wheel with help of chain.
- This result in movement of vehicle or wheelchair.



LITERATURE REVIEW:

SL No	Author	Title name	Methodology and Materials used	Conclusion
1	**Sukhmeet Kaur and Hem chandvasist**	Automation of wheelchair using mems accelerometer	Transmitter Receiver Accelerometer	E wheelchair using head and hand movement
2	**Ritesh N Joshi,RakshitR,Suraj .G.D,Trishul R**	Design and fabrication of multipurpose wheelchair for differently abled persons	Frame,Lobewheel,chair,Gear motor and reduction box, transmission systems	E wheel chairs for climbing stairs
3	**KedarSukerkar*, DarshitkumarSuratwala, Anil Saravade, Jairaj Patil, RovinaD'britto**	Smart Wheelchair: A Literature Review	Artificial intelligence Robotics Sensors Smart wheelchair	E wheel chair for disabled
4	**RAKSHITH R SURAJG D RITESH N JOSHI THRISHOOL R**	DESIGN AND FABRICATION OF MULTI-PURPOSE WHEELCHAIR FOR DIFFERENTLY-ABLED PERSON	Frame Lobe wheels Chair Gear motor and Reduction box Transmission system	E wheel chairs for climbing stairs

MATERIALS USED:

1. WHEELCHAIR

Wheelchairs come in different shapes and sizes. Types of wheelchairs include the folding manual, rigid manual, and electric wheelchair. Before you can really get moving on one, look at what you have. Different types of wheelchairs have different controls and accessories to help you move around.

- Manual wheelchairs all require you to use your arms to turn the wheels.
- A folding wheelchair will fold. A rigid wheelchair doesn't collapse.
- Electric wheelchairs include motors and remote controls to help direct and move you faster.
- All wheelchairs have handles on top of the backrest, so friends and family can push you.

2.BATTERY

A battery is a device that converts chemical energy contained within its active materials directly into electric energy by means of an electrochemical oxidation-reduction (redox) reaction. This type of reaction involves the transfer of electrons from one material to another via an electric circuit.Batteries are a collection of one or more cells whose chemical reactions create a flow of electrons in a circuit. All batteries are made up of three basic components: an anode (the '-' side), a cathode (the '+' side), and some kind of electrolyte (a substance that chemically reacts with the anode and cathode).In this project we have used 2 batteries of 12V 4A in series producing 24V of DC supply.

3.MOTOR

DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal

motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills. The advent of powerelectronics has made replacement of DC motors with ACmotors possible in many applications.

We have used 24volt 350watt(3300rpm) motor

4.MOTOR CONTROLLER

A motor controller is a device or group of devices that can coordinate in a predetermined manner the performance of an electricmotor. A motor controller might include a manual or automatic means for starting and stopping the motor, selecting forward or reverse rotation, selecting and regulating the speed, regulating or limiting the torque, and protecting against overloads and electricalfaults. Motor controllers may use electromechanical switching, or may use power electronics devices to regulate the speed and direction of a motor.

Motor controllers are used with both direct current and alternating current motors. A controller includes means to connect the motor to the electrical power supply, and may also include overload protection for the motor, and over-current protection for the motor and wiring. A motor controller may also supervise the motor's field circuit, or detect conditions such as low supply voltage, incorrect polarity or incorrect phase sequence, or high motor temperature. Some motor controllers limit the inrush starting current, allowing the motor to accelerate itself and connected mechanical load more slowly than a direct connection. Motor controllers may be manual, requiring an operator to sequence a starting switch through steps to accelerate the load, or may be fully automatic, using internal timers or current sensors to accelerate the motor.

5.FREEWHEEL AND FREEWHEEL ADAPTER

In mechanical or automotive engineering, a **freewheel** or **overrunning clutch** is a device in a transmission that disengages the driveshaft from the driven shaft when the driven shaft rotates faster than the driveshaft. An overdrive is sometimes mistakenly called a freewheel, but is otherwise unrelated.

The condition of a driven shaft spinning faster than its driveshaft exists in most bicycles when the rider stops pedaling. In a fixed gear cycle, without a freewheel, the rear wheel drives the pedals around.

An analogous condition exists in an automobile with a manual transmission going downhill, or any situation where the driver takes their foot off the gas pedal, closing the throttle: the wheels drive the engine, possibly at a higher RPM. In a two-stroke engine, this can be catastrophic—as many two stroke engines depend on a fuel/oil mixture for lubrication, a shortage of fuel to the engine starves oil from the cylinders, and the pistons can soon seize, causing extensive damage. Saab used a freewheel system in their two-stroke models for this reason and maintained it in the Saab 96 V4 and early Saab 99 for better fuel efficiency.

6.MOUNTING PLATES WITH BOLTS

- The bolts are used to mount the motor to plate.
- The motor is mounted above the front wheel with the help of mounting plate.
- The material is made up of mild steel material.
- 3 Screws are used to fix the motor on the plate.
- The plate is welded on the front frame.

7.THROTTLE HANDLE

- The throttle valve control motor in this measurement example is a DC motor of which both terminals are connected to an H bridge in the ECU. The duty cycle and frequency of the H bridge signals vary.
- These are mounted on front handle which are used to increase/decrease the speed of the motor.

8.HEAD LIGHT

A headlamp is a lamp attached to the front of a vehicle to illuminate the road ahead. Headlamps are also often called headlights, but in the most precise usage, headlamp is the term for the device itself and headlight is the term for the beam of light produced and distributed by the device.

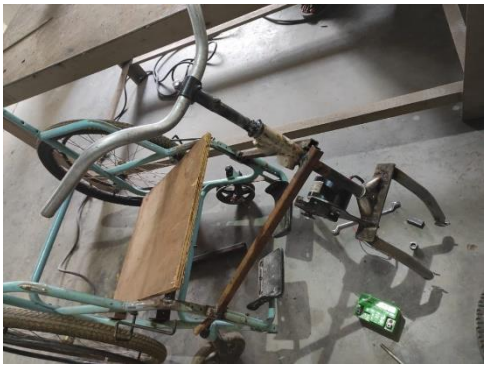
9.SWITCH AND KEY

- It is directly connected to controller.
- It helps to start and stop the power supply to the controller and remaining parts
- Its is necessary in safety point of view

10. SEAT AND BACKREST

- This type of wooden plank is used for seating purpose and back rest
- These planks are fixed to the wheelchair using nuts.
- Additional metals plates were attached to the frame to fix the wooden plank.

11.HANDLE BAR AND FRAME



- The handle is used to change the direction of moving vehicle.
- The frame consists of 2 MS square pipes, handle,handle spindle.
- The square pipes are connected near the foot rests with help of welding.
- The wheel is mounted in the handle spindle with the help of axis.

12. WHEELAND DRIVEN GEAR

- The front wheel is the prime load carrier so the driven gear is attached to it.
- It is attached to handle with the help of shaft.
- The driven gear is attached to the wheel with the help freewheel which is welded to front wheel rim.

13.BRAKE AND BRAKE LEVER.

- Before you start moving around, you'll want to get into your chair. First, make sure your brakes are on by pressing the brake levers.
- The brake arcs are attached at the rear wheels and are operated using brake levers.
- The brake liners connect the arcs with brake levers.
- The levers are attached with cables which are connected to controller.
- When the brakes are engaged the controller slows down the motor.

14.CHAIN.

- Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle,particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles.
- Most often, the power is conveyed by a rollerchain, known as the drivechain or transmissionchain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system.
- Sometimes the power is output by simply rotating the chain, which can be used to lift or drag objects. Though drive chains are often simple oval loops, they can also go around corners by placing more than two gears along the chainBy varying the diameter of the input and output gears with respect to each other, the gearratio can be altered.

WORKING MODEL:

OUTCOMES:

- Eco-friendly vehicle.
- Low budget automated wheelchair.
- Low noise wheelchair.
- Free mobility for disabled people

RESULTS AND CALCULATION

Here we connected four batteries in series so it is called as battery bank. Battery bank specification:

- Battery bank voltage: 24v
- Battery bank capacity: 8 amps

Then, battery bank supply 8amps continuously for 1 hour at 24V

Motor Run time:

- Here assume that we run motor at full load.
- Run time :(1 hour × Battery bank capacity)/full load current
- Let's start by working out the current required to spin up that 250W 24V motor.
- Power in watts = Voltage x current in amps. Or, to find current, divide the power by the voltage… 250 / 24 = 10.41. Very nearly 10 amps.
- It's a 250W motor.
- So, using the relation, P = VI, we get
- I = 250/24
- I = 10.41A
- We need this to run for 1 hour.
- So, I x Time will give us Ah.

- 10.41X1= 10.41.
- Therefore, you'll need a battery pack with 24V and with capacity greater than 10.41Ah.
- The basic relation between watts, volts, and amps are 1 Watt H= 1 V * 1 AH
- So, to run a 24V 250-Watt motor for 1 hours we can use the same relation
- 250 WH = 24V * (1 X AH) - To Run a motor for an hour
- 1 AH = 250 WH /24 V = 10.41AH - To run a motor for an hour
- It is to be noted that the following calculation is for unloaded motor.
- If the source is 24 V, 10.41 Ah, the system can power the motor for up to 10 hours.
- Let, M = The weight in Kg that DC motor can carry=100kG
- g = Acceleration due to gravity 9.8 m/s2
- R = Radius of the shafted wheel / pulley in metres at the edge of which the weight is suspended. =0.21M
- M * g * linear speed = Power [W]=10X9.8=98watts————(1)
- linear speed = Rated RPM*2 * Pi * R /60 [m/s=3300x2x3.142x0.21/60=72.58rps
- Find load torque corresponding to M
- Load Torque = M * g * R [Nm]=100x9.81x0.21=20.601Nm

Equation of the power is:

- P = f*v (P is power in Watt, f is force in Newton and v is velocity in meters /sec)
- Force required for lifting 100kg weight is (100*9.81) = 981 Newton. If you assume lifting speed to be 1 meter / sec, then power required is (981 * 1) = 981 Watt. This much power is required without considering losses in lifting mechanism.
- Generally rated motor speed is 250 rpm.
- Consider a simple lifting arrangement consisting of a rope and pulley. Rope tied to the weight is wound on the pulley which is rotated by the motor. Even if you use a very small pulley of say 900 mm dia directly mounted on motor shaft, it will result in lifting speed of (900*3.14*250) mm/minute = 7,06,950 mm / minute = 11,782.5 mm / sec = 196.375meter / sec, which is too high speed. Hence you should use a reduction gear, to match your speed requirement. Considering losses in the speed reduction gear and pulley, efficiency may be 50% and motor output power has to be 98.1 / (50/100) = 392.75 Watts.

ADVANTAGES:

- Independent movement for disabled people
- Can be used by industrial workers
- It is rechargeable
- It is environment friendly
- It uses no fuel hence no exhaust is released

DISADVANTAGES:

- This is a low-speed vehicle
- This has wight carrying capacity maximum 100kgs
- Can’t be used for longer distances

CONCLUSIONS:

Free mobility of disabled people is required to reduce their dependence on others, to ensure that we have designed a wheel chair that gives both free mobility and is also cost effective, the wheel chair is made cost effective by keeping in mind the middle-class people and poor people. The chair also encounters some problems like reverse movement and suspension

FUTURE SCOPE:

- Suspension system should be added
- System (gear or switch) should be added for Reverse movement
- We can reduce the vehicle length and can also ensure better power transmission by giving the drive at rear wheels.

REFERANCE:

- Sukhmeet Kaur and Hem chandvasist

  Automation of wheelchair using mems accelerometer

- Ritesh N Joshi,RakshitR,Suraj .G.D,Trishul R

  Design and fabrication of multipurpose wheelchair for differently abled persons

- KedarSukerkar, DarshitkumarSuratwala, Anil Saravade, Jairaj Patil, RovinaD'britto

  Smart Wheelchair: A Literature Review

- RAKSHITH R SURAJG D RITESH N JOSHI THRISHOOL R

  Design And Fabrication of Multi-Purpose Wheelchair for Differently-Abled Person.

Youtube Video Link Of Our Project: https://youtu.be/SqNHbJks-Kk