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Design and Fabrication of Automated Wheelchair

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ABSTRACT

Wheelchairs are used by people to whom walking is difficult or impossible due to illness, injury or disability. Driving a manual wheelchair or crutches is a difficult task and past invented automatic wheelchair are not available in present market that can be bought and used for physically disable persons. The purpose of this research work is to propose of an automated wheelchair system which facilitates the users. The proposed wheelchair has been implemented with design, simulation and construction of the whole body. Automated Wheel Chair assists disabled people to become more mobile and independent. The main objective of this project is to design and fabricate a cheap, intuitive and practical automated wheelchair. Many of the disabled persons uses hand powered wheelchair who do not have the physical strength or coordination to propel themselves on the tricycle with their arms and hands. This automated wheelchair has the potential to deliver increased freedom to a considerable consumer base. The proposed system presents a user friendly tricycle which can be easily assembled to the wheelchair at any time. It has front wheel propelled mechanism with hub motor installed inside the wheel. The controller is the brain of the automated wheelchair, controlling the motor speed, start, stop. As it is connected to all other electronic parts such as battery, motor, and the throttle, display (battery indicator). The disabled people who use a normal wheelchair for mobility and navigation requires an another person for support and to move around. Mobility of disabled people is concerned social issue nowadays. Here comes the need of an automated wheelchair, which adds on power to the manual wheelchair with its user friendly tricycle.

Keywords : Wheelchair, Motor, Tricycle, Battery

I. INTRODUCTION

A wheelchair is a wheeled mobility device in which the user sits. The device is propelled either manually or via various automated systems. Wheelchairs are used by people for whom walking is difficult or impossible due to illness, injury, or disability. People walking disability often need to use a wheel bench. Wheelchairs are often variations on this basic design, but there are many types of wheelchairs, and they are often highly customized for the individual user's needs. The seat size (width and depth), seat-to-floor height, footrests/leg rests, front caster outriggers, adjustable backrests, controls, and many other features can be customized on, or added to, many basic models, while some users, often those with specialized needs, may have wheelchairs custom-built. This paper focuses on the emerging trend of automated wheelchair.

The automated wheelchair is a wheelchair driven with the help of a tricycle. The front wheel of the tricycle is driven in which a hub motor is installed for its mobility. The disabled people who use manual wheel chair they often experience shoulder pain due to steering wheelchair with only the upper limb muscles for a long time. Some disable peoples need medical treatment and also have surgical treatment in serious case, to these potential muscles disorders there must be need of an automated and efficient mobility vehicle which can fulfill their basic needs and service them without the help of any other person. Several type of electrical hand bike have been recently introduced in which the mobility is either by manual powered or electrical powered.

Hub motor:

Wheel hub motor is an electric motor positioned in the wheel of the of tricycle which drives directly. First wheel hub motor concept was discovered by Wellington Adams of St. Louis in the year 1884.He conceived of building an electric motor directly in the vehicle wheel, though it was attached via complicated gearing.One of the biggest advantages of hub motors is that they require little or no maintenance. They are an entirely independent drive system that retain all of their components inside the motor casing, there are two types of hub motors: geared hub motors which have internal planetary gears to reduce the speed of a higher RPM motor, and gearless hub motors, which have no gearing and directly connect the lower RPM motor stator's axle to the bike. Gearless hub motors, on the other hand, have zero moving parts aside from their bearings, so there is basically nothing to wear out. As long as they don't rust out or wear down their bearings, they can pretty much last forever.

Fig: 1.1. Motor HUB

Brushed and Brushless Hub Motors

Modern e-bikes all prefer to use "brushless" hub motors, just because they are more durable than its "brushed" counterpart, besides the maintenance cost in them is also very little. Limited in quantity making them expensive comparatively. But in the long run they seem to be lot reliable. Both by the cost and performance. They function little differently again as are described here below.

a. Brushed Hub Motors In a brushed hub motor, small metal "brushes" which transfers electrical energy to the commuter, a rotating part of the motor. This contact wears the brushes in some course of time, and it is around 3000 miles of use, these brushes have to be replaced. This replacement is not so expensive but to manage this work itself is not so easy. It has advantage in the sense that it needs less complex controllers, making it less costly but it is still encouraged to use brushless motors only for the reason that once the motor is opened for repair, it cannot be converted to the original standard.

b. Brushless Hub Motors In a brushless motor, as there is no physical contact from any parts of the motor inside, therefore there is virtually no wear and tear possibilities, making the motor's durability limitless. These motors have more sophisticated controllers, and it makes it possible for using three different windings, and power is supplied individual windings according to the position they are in the movement. When the motor passes one winding, the controller passes the power to another winding, making the movement to continue without stopping. These types of motors are quite popular nowadays. In this automated wheel chair the hub motor is of 36V,350 watts with16 inches copper wire bending inside. Top speed limited up to 20km/hr.

Controller

The controller is one of the main parts of an automated wheelchair; it is the brain of the automated wheelchair, controlling the motor's speed, start, stop. It is connected to all the other electronic parts such as the battery, motor, and the throttle (accelerator), display(speedometer),

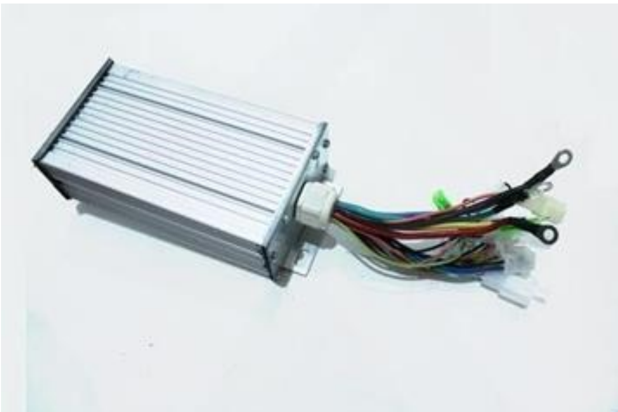

Fig: 1.2(a). Controller

A controller is composed of main chips (microcontrollers) and peripheral components (resistors, sensors,etc). Generally, there are PWM generator circuit, AD circuit, power circuit, power device driver circuit, signal acquisition and processing circuit, over-current and under-voltage protection circuit inside the controller.

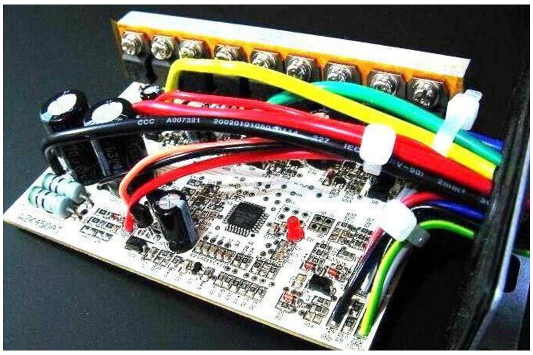

Fig: 1.2(b). Parts in controller

Working of Controller

After connecting the battery, the controller supplies the working voltage to the external device through the power circuit, such as the switch +5V, headlight + 5V, etc. The PWM outputs a corresponding pulse waveform to the MOSFET(metal–oxide–silicon transistor) drive circuit based on the input of the throttle or PAS. The MOSFET drive circuit controls the turn-on and turn-off of the MOSFET circuit to control the motor speed.The under-voltage circuit is to protect the battery from discharging when the voltage is lower than the controller set value, at this time the PWM circuit stops the output.

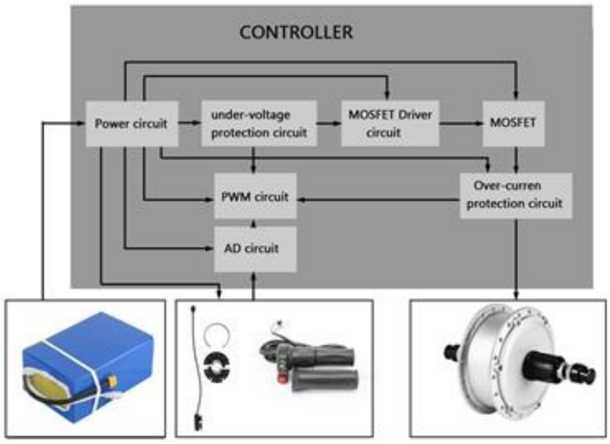

Fig: 1.3. Working of Controller

The over-current protection circuit limits the working of the controller, battery, motor at an over higher current. The core function of an electric bike controller is to take all the inputs from all the electric components (throttle, speed sensor, display, battery, motor, etc.) and then determine what should be signaled in return to them (motor, battery, display).Other multiple protection functions of the controller will be different from the controller's design. Following are some basic protection functions.

1) Over-voltage protection. The controller monitors the battery voltage and shut down the motor when the battery voltage is too high. This protects the battery from over-charge.
2) Low-voltage protection. The controller monitors the battery voltage and shut down the motor when the battery voltage is too low. This protects the battery from over-discharge.
3) Over-temperature protection. The controller monitors the temperature of the FET(field-effect transistor) and shut down the motor if they become too hot. This protects the FET power transistors.
4) Over-current protection. Reduce the current to the motor if too much current is being supplied. This protects both the motor and the FET power transistors.
5) Brake protection. The motor shut down when braking even though other signals taken by the controller at the same time. For example, if the user applies brake and throttle at the same time, the brake function wins.7

Controller Connections

The wire types and wire terminal (connector) of the controller could be different in the different controller design. You need the controller wiring diagram to ensure the right wiring connections. Most controller will have these wires motor, battery, brakes, throttle/ accelerator Some more wires are found in the advanced controllers, such as Display or speedometer, Three speeds, Reverse, LED light, etc.

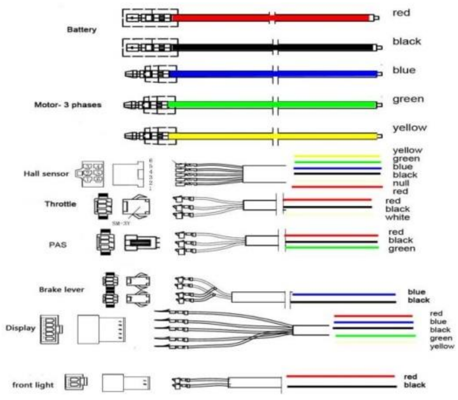

Fig: 1.4. Controller Connections

Battery

Lithium ion batteries, these are very popular among technologies. They offer many advantages, They are lighter than many other rechargeable batteries of a similar size. They are great at holding their charge; a lithium ion battery pack only loses about 5% of its charge per month in comparison to 20% loss for NiMH batteries. They have no memory effect. You don't need to completely discharge the battery before recharging they are able to handle hundreds of charge and discharge cycles. Lithium ion batteries contain lithium ion cells, they may be cylindrical batteries that look very similar to regular AA batteries. The battery type is Lithium-ion battery, which is considered to be the best among the available batteries according to the performance report obtained in comparative study on various batteries and other aspects like condense percentage and weight. This rating is placed by industries strictly based on the efficiency level and maximum durability. We have used lithium-ion battery of 48watt 10amp In automated wheelchair.

Fig: 1.5. Lithium ion Battery

Throttles

Fig: 1.6. Throttles

The throttle mode is similar to how a motorcycle or scooter operates. When the throttle is engaged the motor provides power and propels you and the bike forward.The throttle used in our project is universal forward and reverse throttle with cable length of 60cm.The throttle is suitable for about 22cm of handle bar. The throttle is easy to use with a switch of reverse take adjacent to the throttle and it is very much effectively used in very less time.

1.1.8 Brakes

We have installed e-brakes to our project. As e-brakes is an essential part of our system. These are mainly used in ebikes.They cut power to the motor. It also engages the regenerative braking system when the lever is pulled. The brakes are linked to the controller by means of lever which when pulled generates current and stop the moving wheel.

Fig: 1.7. Brakes

Battery Indicator, Ignition switch and Head Lamp

This power indicator can be used for modification and upgrade. It is small and exquisite, occupying a small space, easy to install and fix, simple wiring, practical function and affordable price. It is a good choice for personal car repair.

The internal display of the power indicator is sampled by a Zener tube, the array resistor is added with a triode for signal amplification, and the array transistor is used to accurately display the state of the power. This technology is mature and stable, and is the best component for retrofitting and upgrading.

Fig; 1.8. Battery Indicator, Ignition switch and Head lamp

The working principle is specially described: there are 6 display lights in this battery display, and the first one on the left is the under- voltage lamp. When the battery is under voltage, the light is on, and it is not bright. The last 5 lights are the power indicator lights. When the battery is fully charged, the 5 lights are all on. The lower the voltage, the less the display quantity of the display lights. The display lights are dimmed to off, and then decremented. It comes with head lamp which can illuminate the darkness which can be helpful in night time for the disabled people to move from place to another place.

Statement of Problem

The global disabled population is increasing due to population growth, ageing, and emergence of chronic conditions such as road-traffic accidents, landmines, war and violence. Many of these disabled people need a wheelchair. Mobility is a birthright – it is necessarily a fundamental right, and people have a right to have a wheelchair. For many who are unable to walk independently, an automated wheelchair provides mobility. With an automated wheelchair, one can exercise freedom of movement. Independent mobility can make it possible to study, work, participate in cultural life, and access medical care, leading to inclusion and equal participation. Benefits of having a wheelchair An Automated wheelchair are beneficial for the physical health of the user. It decreases common health issues such as pressure sores, the progression of deformities or contractures, and other secondary conditions, resulting in reduction of health care expenses. It facilitates improved respiration, digestion, and better posture. All these results lead to increased activity levels and a better quality of life. Automated Wheelchairs make a difference when compared to a manual wheel chair. An automated wheelchair can change a disabled person's situation from:

- Isolation to inclusion,
- Dependency to freedom,
- Passive receiver to active contributor.

Disabled children can go to school and adults can make an income, and people will often live longer when using an automated wheelchair. However, despite of all these advantages, the majority of disabled people cannot afford to have a wheelchair.

Objective

In many developing countries, only 2-5% of population who are in need of rehabilitation services, can access it. Among rehabilitation services, one of the neglected areas is wheelchair or mobility devices. Many developing countries have very little capacity to produce wheelchairs and mostly depend on foreign donation. The majority of donated wheelchairs fail to match individual needs or survive in the environment where majority live. So the main objective of this project work is to design and fabricate a cheap, intuitive and practical automated wheelchair easily available to every needy. The standard rules on the equalization of opportunities for persons with disabilities Twenty-two rules have been adopted by the United Nations General Assembly, Forty-eighth Session, 1993.

II. Literature Review

In case of relatively high speed on various terrains after easy installation using a connecter, the mechanical loads are continuously applied to the connecting parts between manual wheel chair and electric hand bike, And the resultant force accumulated at the connecting parts is determined to affect the structural stability of connecting parts. However related research on this area are still rear therefore this study aims to implement a three dimensional dynamically model that can simulate durability test through analysis, and to evaluate dynamic structure stability of parts between manual wheelchair and automated wheelchair.

It is uncertain as to what can be considered the first wheelchair, or who invented it. However, its origins date back to ancient times. The earliest records of a wheeled transportation device were found on a stone slate in China and a child's bed depicted in a frieze on a Greek vase, both dating between the 6th and 5th century BCE.

The first records of wheeled seats being used for transporting disabled people date to three centuries later in China; the Chinese used early wheelbarrows to move people as well as heavy objects. A distinction between the two functions was not made for another several hundred years, around 525 CE, when images of wheeled chairs made specifically to carry people begin to occur in Chinese art.

Kink Phillip II of Spain

The first known wheelchair purposefully designed for disability and mobility was called an "invalid's chair". It was invented in 1595 specifically for King Phillip II of Spain. The chair had small wheels attached to the end of a chair's legs and it included a platform for Phillip's legs and an adjustable backrest. It could not be self-propelled but most likely the King always had servants transporting him around.

First Self-Propelling chair

In 1655, Stephan Farffler, a 22 year old paraplegic watchmaker, built the world's first self-propelling chair on a three-wheel chassis using a system of cranks and cogwheels. However, the device had an appearance of a hand bike more than a wheelchair since the design included hand cranks mounted at the front wheel.

The Bath Wheelchair

In 1783, John Dawson of Bath, England, invented a wheelchair named after the town of Bath. Dawson designed a chair with two large wheels and one small one. The Bath wheelchair outsold all other wheelchairs throughout the early part of the 19th century.

Late 1800's

However, the Bath wheelchair was not that comfortable and during the last half of the 19th century many improvements were made to wheelchairs. An 1869 patent for a wheelchair showed the first model with rear push wheels and small front casters. Between, 1867 to 1875, inventors added new hollow rubber wheels similar to those used on bicycles on metal rims. In 1881, the pushrims for added self-propulsion were invented.

The Folding Wheelchair

In 1932, engineer, Harry Jennings, built the first folding, tubular steel wheelchair. That was the earliest wheelchair similar to what is in modern use today. That wheelchair was built for a paraplegic friend of Jennings called Herbert Everest. Together they founded Everest & Jennings, a company that monopolized the wheelchair market for many years. An antitrust suit was actually brought against Everest & Jennings by the Department of Justice, who charged the company with

Everest-Jennings-Folding-Frame

The first wheelchairs were self-powered, and worked by a patient turning the wheels of their chair manually. Of course, if a patient was unable to do this, another person would have to push the wheelchair and patient from behind. A motorized or power wheelchair is one where a small motor drives the wheels to revolve. Attempts to invent a motorized wheelchair were made as far back as 1916, however, no successful commercial production occurred at that time.

The first electric-powered wheelchair was invented by Canadian inventor, George Klein and his team of engineers while working for the National Research Council of Canada in a program to assist the injured veterans returning after World War II. George Klein also invented the microsurgical staple gun. Everest & Jennings, the same company whose founders created the folding wheelchair were the first to manufacture the electric wheelchair on a mass scale beginning in 1956.

Hand powered Wheelchair

Hand-powered tricycles are presently being used to provide mobility for disabled persons in a rural community across the world. Hand- powered wheelchair with special accessories – however operated involved 20 people with disabilities, distance covered by a few hundred kilometers of roads of different regions of Lithuania. Marathon – a challenge for people with physical disabilities who overcomes on a daily basis, about 40 – 60 kilometers educating the hot sun or rain heavy rain. The project is conducted in cooperation with the NGO "amendment was accepted – disabled persons company more than 12 years. overhauling the various compensatory equipment, including wheelchairs and producing special accessories – propulsion, which greatly enhances the possibilities to move a wheelchair .

Electric Tricycle Wheelchair

The design of the Electric Tricycle is adaptable to the current hand- powered tricycles with little modification. The design consists of an electric motor, a drive system, mxox tor and steering controls, and a power.

An electric motor was chosen because high fuel costs prohibited the use of a combustion engine and because of the availability of electricity in Mahadaga. A solar array that provides electricity for the Handicap Center provides the ideal source of electricity for battery recharging. The first aspect of our design that was addressed was the drive system or means of power transmission. Power must be transmitted from the electric motor to a rear wheel of the tricycle. Second, a method of motor control was decided on. The controls for motor speed and braking were incorporated into a simple mechanical joystick to facilitate operation by users with limited dexterity. The hand-power system was replaced with a steering system that disables the hand-power capability of the tricycle. Third, power is supplied to the motor by a battery pack. All the above components (motor, transmission, controls, and batteries) were designed to be able to be installed on the existing hand-powered tricycles. Everything necessary to convert a hand-powered tricycle to the Electric Tricycle is simple to install, and the conversion is reversible. Our objectives for the project are as follows, in order of decreasing priority:

- Be able to climb a 10% grade
- Limit top speed to 7 mph
- Have a power supply that will provide a range of 8 miles at maximum speed
- Total cost of power train and controls and power supply will not exceed 25,000

Hand Cycle Add-On/Conversion to Wheelchair

A hand cycle is a type of human-powered land vehicle powered by the arms rather than the legs, as on a bicycle. Most hand cycles are tricycle in form, with two coasting rear wheels and one steerable powered front wheel. Despite usually having three wheels, they are also known as hand bikes.

Many manufacturers have designed and released hand-powered recumbent trikes, or hand cycles. Hand cycles are a regular sight at HPV meets and are beginning to be seen on the streets. They commonly follow a delta design with front wheels driven by standard derailleur gearing powered by hand cranks. Brake levers are usually mounted on the handholds which are usually mounted in phase, unlike pedal cranks, which are usually 180° out of phase. This allows the rider to more easily use their torso to help propel the cycle. The entire crank assembly and the front wheel turn together, allowing the rider to steer and crank simultaneously Some designs use two front wheels and a single rear wheel, while others use lean-steer designs. A hand cycle is not a wheelchair hand cycle has a crank and gears, while wheelchair has push-rims directly on the main wheels.

In our project of automated wheelchair we found many products that were available for purchase, but they didn't entirely meet the requirements of our unique problem. The problem has been solved, and in many different ways, but what we found, or rather didn't find, was a solution to our problem that meets our specific needs of affordability and appropriateness. The advantage of finding these solutions is that we can see what works, what has been tried, and what's available on the market. Then we can more effectively consider how to design a similar product that meets our unique needs. We began the design project with three drive options for transmitting power from the electric motor to the drive wheel. First, a hub motor was considered. The hub motor incorporated the motor and transmission into the hub of the wheel. This design was very simple and offered the advantage of a sealed, self-contained drive system

This attachment lets you get to more places with less effort, so reducing fatigue and shoulder strain, and increasing independence. The automated wheelchair attachment has a 350W motor located in the hub of the wheel, which is controlled by separate forward and reverse throttles.

It has a maximum speed of twelve miles per hour and with one charge of the lithium-ion battery, you can travel a maximum distance of 15 miles. It takes about four hours to fully charge the battery which is lightweight and removable, and the charger comes included.

III. Methodology

Fig: 3.1 D Diagram of automated wheel chair

An automated wheel chair is a powered wheelchair by a battery as an energy source. The battery would kick out a steady electric current, driving the dynamo in reverse so that it spun around in hub motor. As the dynamo/motor turned, it would rotate the tire and make the tricycle go along without any help. The tricycle is the simplest and user friendly mobility device. The wheelchair attached to it follows the path as the steering is at the tricycle and it is the drive mechanism

The tricycle is attached to wheelchair with the help of clamp. A hollow shaft is made at the footrest of the wheelchair to which tricycle is attached and clamped on and off easily in very less time. The tricycle consists of a controller which is the brain of the whole system. It assists the commands of speed, break etc. The battery is placed at the front portion of tricycle which gives the power to run the wheelchair.

Material Selection

Mild steel (iron containing a small percentage of carbon, strong and tough but not readily tempered), also known as plain-carbon steel and low-carbon steel, is now the most common form of steel because its price is relatively low while it provides material properties that are acceptable for many applications. Mild steel contains approximately 0.05–0.30% carbon making it malleable and ductile. Mild steel has a relatively low tensile strength, but it is cheap and easy to form; surface hardness can be increased through carburizing.

In applications where large cross-sections are used to minimize deflection, failure by yield is not a risk so low-carbon steels are the best choice, for example as structural steel. The density of mild steel is approximately 7.85 g/cm3 (7850 kg/m3 or 0.284 lb/in3) and the Young's modulus is 200 GPa (29,000 ksi). Low-carbon steels display yield-point runout where the material has two yield points. The first yield point (or upper yield point) is higher than the second and the yield drops dramatically after the upper yield point. If a low-carbon steel is only stressed to some point between the upper and lower yield point then the surface develops slip bands. Low-carbon steels contain less carbon than other steels and are easier to cold-form, making them easier to handle.

Working in Construction

Tricycle Linkage Mechanism:

The tricycle gets attached to the wheelchair by the help of clamp. When the tricycle attached to the hollow shaft present at the footrest of wheelchair by means of a hole on the tricycle the clamp is slide on and it gets fixed to the wheel chair. The purpose of placing the system at the footrest is that it will be helpful to the disabled person to mount and clamped on and off the tricycle easily.

Fig: 3.2. Tricycle Linkage Mechanism

Operations Performed

Bending Operation

The rods which are used at the footrest are bended accordingly to design of the wheelchair.

Fig: 3.3. Bending Operations

3.5.2 Cutting operation

In the context of machining, a cutting tool or cutter is any tool that is used to remove some material from the work piece by means of shear deformation. Cutting may be accomplished by single-point or multipoint tools. Single-point tools are used in turning, shaping, planning and similar operations, and remove material by means of one cutting edge. Milling and drilling tools are often multipoint tools. It is a body having teeth or cutting edges on it. Grinding tools are also multipoint tools. Each grain of abrasive functions as a microscopic single-point cutting edge (although of high negative rake angle), and shears a tiny chip.

Cutting tool materials must be harder than the material which is to be cut, and the tool must be able to withstand the heat and force generated in the metal-cutting process. Also, the tool must have a specific geometry, with clearance angles designed so that the cutting edge can contact the work piece without the rest of the tool dragging on the work piece surface. The angle of the cutting face is also important, as is the flute width, number of flutes or teeth, and margin size. In order to have a long working life, all of the above must be optimized, plus the speeds and feeds at which the tool is run.

Fig.3.4. Cutting operation

3.5.3 Grinding operation

Grinding is a finishing process used to improve surface finish, abrade hard materials, and tighten the tolerance on flat and cylindrical surfaces by removing a small amount of material. In grinding, an abrasive material rubs against the metal part and removes tiny pieces of material. Grinding is an abrasive machining process that uses a grinding wheel as the cutting tool. To grind means to abrade, to war away by friction or to sharpen. In manufacturing it refers to the removal of metal by an abrasive wheel rotating at high speeds and working on the external or internal surface of a metallic or other part hard enough to be abraded, rather than indented by the grinding wheel. The action of the grinding wheel is similar to that of a milling cutter. The grinding wheel is composed of many small abrasive particles bounded together, each one acting as a miniature cutting point. Grinding removes metal from the work piece in the form of small chips by the mechanical action of abrasive particles bonded together in a grinding wheel.

Fig: 3.5. Grinding operation

3.5.4 Welding Operation

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by using high heat to melt the parts together and allowing them to cool, causing fusion. Welding is distinct from lower temperature metal-joining techniques such as brazing and soldering, which do not melt the base metal.

In addition to melting the base metal, a filler material is typically added to the joint to form a pool of molten material (the weld pool) that cools to form a joint that, based on weld configuration (butt, full penetration, fillet, etc.), can be stronger than the base material (parent metal). Pressure may also be used in conjunction with heat or by itself to produce a weld. Welding also requires a form of shield to protect the filler metals or melted metals from being contaminated or oxidized flux to lay the weld. To strike the electric arc, the electrode is brought into contact with the work piece by a very light touch of the electrode to the base metal. The electrode is then pulled back slightly. This initiates the arc and thus the melting of the work piece and the consumable electrode, and causes droplets of the electrode to be passed from the electrode to the weld pool. Striking an arc, which varies widely based upon electrode and work piece composition, can be the hardest skill for beginners. The orientation of the electrode to work piece is where most stumble, if the electrode is held at a perpendicular angle to the work piece the tip will likely stick to the metal which will fuse the electrode to the work piece which will cause it to heat up very rapidly. The tip of the electrode needs to be at a lower angle to the work piece, which allows the weld pool to flow out of the arc. As the electrode melts, the flux covering disintegrates, giving off shielding gases that protect the weld area from oxygen and other atmospheric gases. In addition, the flux provides molten slag which covers the filler as it travels from electrode to the weld pool. Once part of the weld pool, the slag floats to the surface and protects the weld from contamination as it solidifies. Once hardened, it must be chipped away to reveal the finished weld. As welding progresses and the electrode melts, the welder must periodically stop welding to remove the remaining electrode stub and insert a new electrode into the electrode holder. This activity, combined with chipping away the slag, reduces the amount of time that the welder can spend laying the weld, making SMAW one of the least efficient welding processes. In general, the operator factor, or the percentage of operator's time spent laying weld, is approximately 25%.

Fig: 3.6. Arc welding

IV. RESULTS AND DISCUSSION

Fig: 4.1. Final model of automated wheel chair

In our project we made the changes compared to the available electric wheelchair. We believe that our project will be effective in providing mobility for disabled people at affordable price. As mobility is the basic need of every disabled person and we have made our project by considering its reliability, efficiency and effectiveness.

3D Design of Wheelchair

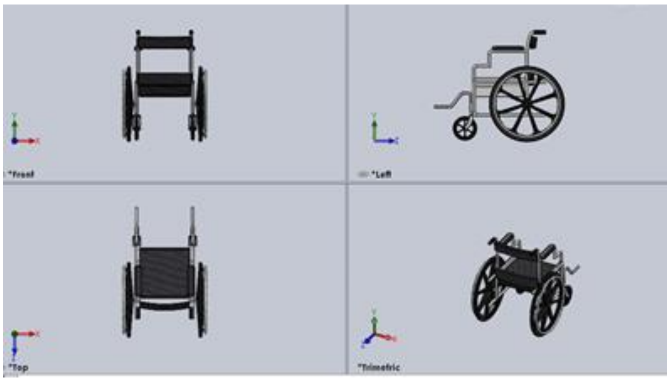

Fig: 4.2. 3D Design of Wheelchair

Geometry of wheel chair with side view is shown in the above figure

3D Design of Automated Wheelchair

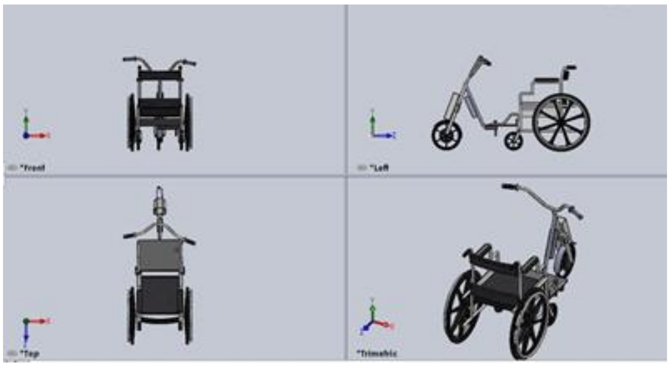

Fig:4.3. 3D Design of Automated Wheelchair

The above 3D model of automated wheelchair is done on Catia V5 software.

Parts 3d modelling

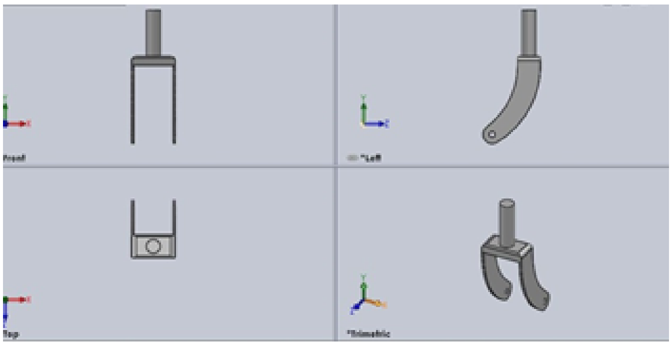

Fig:4.4. Caster Fork views

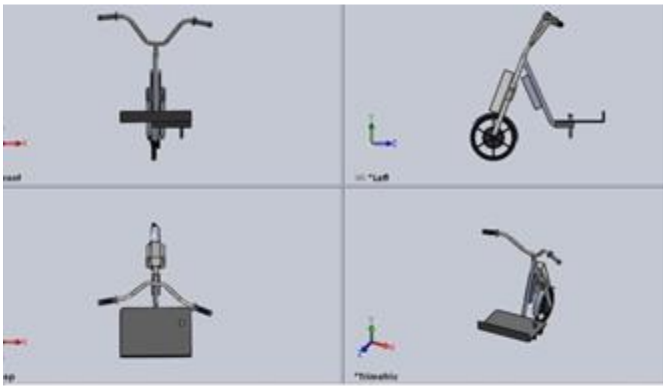

Fig:4.5. Detachable Parts

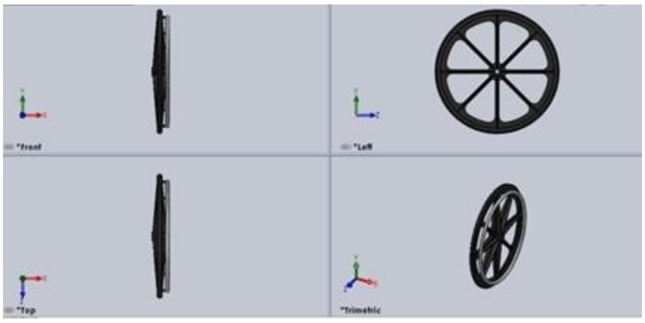

Fig: 4.6. Back Wheel Views

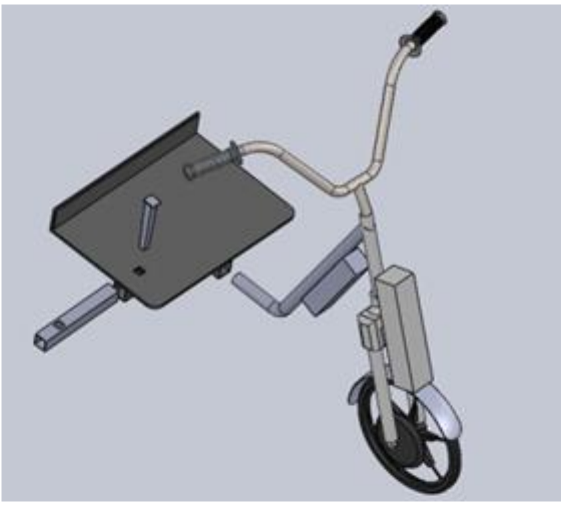

Fig:4.7. Exploded View of detachable parts

Fig: 4.8. Motor, Handle, Frame, Battery

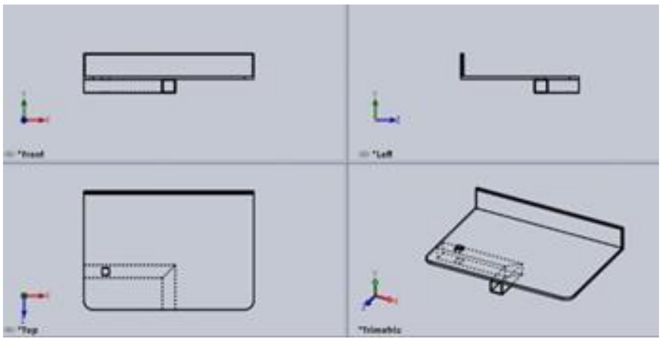

Fig: 4.9. Foot Rest all view

V. CONCLUSION

The main theme of this project has been to make people aware of this technology, and make it popular among the general mass, so that it helps improving this world by reducing the disability problems. There has always been this willingness in human race to improve the ongoing technology that is prevailing at a particular time, by bringing a more sophisticated and advanced product than that is what presently available today. This act what actually leads into bringing new developments, progress in every aspect of life for better livelihood all around. That is why by the improvements and growth in science and technology in recent decades, we can see similar progress in the field of transportations also. As we know development is a continuous process and until it reaches into a state of complete perfection, there is always room for its improvements, and our study is just to support this idea. We would say that our project has been successful with considering the changes we had to make when compared to the available electric wheelchair. We believe that our project will be effective in providing mobility for disabled people at affordable price. As mobility is the basic need of every disabled person and we have made our project by considering its reliability, efficiency and effectiveness. Its utilization will be very much helpful for the NGOs as availability of automated wheelchair at affordable range of price will be financially and socially helpful. We have tried to analyze the properties of automated wheelchair, especially the role of controller, motor, along with batteries, so that it may help to improvise this technology where it may be necessary. The main objective is just to highlight its importance among common public, and establish it as a more secured and reliable alternative for inside city transportation, homely use, NGOs.

VI. REFERENCES

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