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Design and Manufacturing Lowerlift Mobilitas

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Abstract: *Reduced mobility is something that many of us do not think twice about, but it is something that millions of people all over the world live with every day. There are of people in the world who suffer from disabilities on a level that few of us could imagine. As per Census 2011, in India, out of the total population of 121 crore, about 2.68 Cr persons are 'Disabled' (2.21% of the total population). Person with disability" means a person with long term physical, mental, intellectual or sensory impairments which, in interaction with barriers, hinders his full and effective participation in society equally with others.*

Mobility impairment is defined as a category of disability that includes people with varying types of physical disabilities. Mobility impairments can be permanent or temporary. A broken bone or surgical procedure can temporarily impact a student's ability to walk independently and travel between classroom buildings in a timely manner. Likewise, some students may be ambulatory with a walker for short distances within a classroom, but may need a wheelchair or scooter for longer-distances.

Keywords: Mobility Device, Analysis, Gear Moter, Novelty, Solar Photovoltaic Panel, Battery Charging

I. INTRODUCTION

What is Meant by Cough?

Total No of Disabled person with lower body disorder are 61,05,477 as per census india.gov.in officially and are many more unofficially. As we see these numbers are really big and are seeing very minimal steps taken in for them regarding there mobility. An overview of mobility device for persons with disabilities including manual and electric wheelchairs. Generally, there are wheel chairs which are very difficult to climb by their self and are most often dependent on others for their movement from one place to another. Even if the wheel Chair are made self-dependent by driving it through electrical Power and Motor, they cause lakhs of Rupees.

Problem Faced by Lower Body disordered people by using available devices: -

1. Hands with Blisters
2. Dirty Hands
3. Inaccessible Heights
4. Stuck into Narrow passage
5. Difficulties in driving on Roads.

The Solution brought by our group is a manual as well as a electric mobility device for lower body disorder.

Problem statement

There are very minimalistic opportunity and options for motion for disordered people like manual wheel chairs, electric wheel chairs, Handsticks, Roller boards etc. All these transportations have many disadvantages like Hands with Blisters, Dirty Hands, Inaccessible Heights, Stuck into Narrow passage, Difficulties in driving on Roads.Seeing the disadvantages of utilization of wheel chair and other mobility device for these disordered people are inefficient and painful.Moreover, there should be any other alternative that can solve these problems without any painful activity.The electrically operated wheel chair removes painful activity and is one source that can mobility easier for people but these electrical wheel chairs are too expensive that hardly few of them can afford themselves.

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Objectives

- Easy access to the device without anyone's support.
- Providing environmental friendly product.
- Easy means for transport without any painful activity.
- To reduce the dependency on other for their mobility.
- Switching the manual transportation with electrical support

Scope

The project future scope is very bright as it has many applications in future not only for the disordered people but also they can be a great helping hand in the industrial as well as domestic uses.

Some Major Application that are feasible with the project in near future are: -

- Can be used as a towing cart within a factory for towing light weight goods.
- They can be used as transportation facilities for disabled at Railway Station, Airports etc
- They can also be a fun activity for small kids.
- The personal mobility devices market is estimated to be valued at US$ 12.71 billion in 2023 and is expected to reach US$ 30 billion by 2033. The adoption of personal mobility devices is likely to advance at a CAGR of 9% from 2023 to 2033.

II. METHODOLOGY

Design

Conceptual Design-

Fig.1

The First and the foremost step in any project come the design of it i.e., designing its 3-D model with help of different software's available.

The designing step is one of the most important steps involved in any kind of work that is to be manufactured. To design is much more than simply to assemble, to order, or even to edit; it is to add value and meaning, to illuminate, to simplify, in-order to know all specific form of details that would be required to manufacture the model.

All the designing in done on Solidworks platform as it is one of the most easiest and most efficient 3-D Modelling software.

The Design include all the parts and components like frames Frame, Battery, Motor, Tires, Handle and Front unit, Braking Unit etc.

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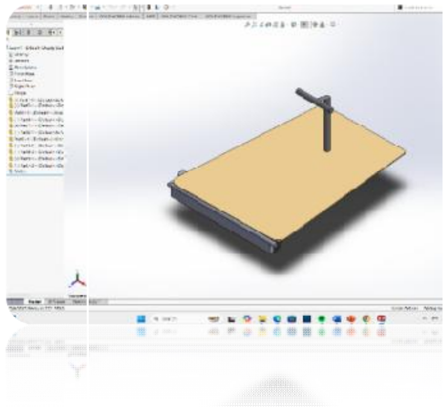


Fig.2

BASE DESIGN

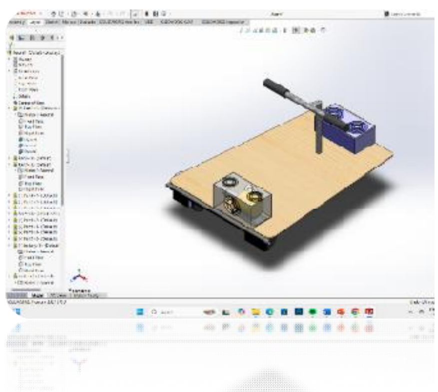


Fig.3

NEW DESIGN

Components and their Specification

FRAME: After doing some Literature review and analysis, we found that Galvanized pipe would be one of the best materials to form a frame. Therefore, the Frame is built of Galvanized pipes as they have a capacity to bear a load of 150 kg. First The conceptual design of the frame was built on Solidworks platform which is shown in Fig 3. After doing all the detail analysis about the frame and its material and its shape the frame was brought into actual fabrication. The Fig 4 represents the actual fabricated Frame.

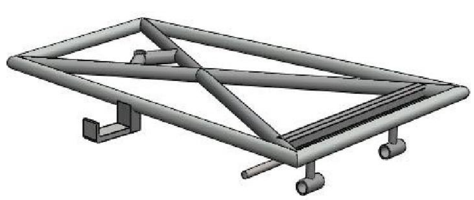


Fig 4

Fig 5

PU Industrial Tire: Pu Industrial Tyre also called as Polyurethane Tires. These tires are named in such way because the are made up of polyurethane resins. The qualities and benefits of polyurethanes are far superior to those of traditional rubber in a variety of applications.

Motor: The motor used in 24V 350W brushless Geared DC motor. A brushless DC electric motor also known as an electronically commutated motor (ECM or EC motor) or synchronous DC motor, is a synchronous motor functions using a direct current (DC) electric power supply. We have used motor with this specification because our project requires less speed and high Torque since it is for person with lower body impairment.

Lithium Ion Battery: A lithium-ion battery or Li-ion battery is a type of rechargeable battery composed of cells in which lithium ions move from the negative electrode through an electrolyte to the positive electrode during discharge and back when charging. Compared with traditional battery technology, lithium-ion batteries charge faster, last longer and have a higher power density for more battery life in a lighter package. The Lithium-Ion battery we used is of following

Specification: -

Voltage: - 24 Volts

Max Current Output: - 12 Ampere

Using equation V*AH/1000 = Motor capacity (in KW), Voltage of motor is 24 V, Motor capacity is 1 KW(1000W). So by equating these values, we get 24*AH/1000=1. From these we get AH is 11.6. Since this battery are available in Standard size and therefore as per the application the battery purchased is of Above Specification.

Throttle: A throttle is the mechanism by which power flow is managed in-order to maintain power due to which the speed is controlled. The throttle we have used is SNA Throttle 24v Electric Scooter/e-bike Electric vehicle Throttle.

Electronic Speed Controller Unit (E.S.C): An electronic speed control (ESC) is an electronic circuit that controls and regulates the speed of an electric motor. It may also provide reversing of the motor and dynamic braking. Miniature electronic speed controls are used in electrically powered radio- controlled models. Full-size electric vehicles also have systems to control the speed of their drive motors. The E.S.C. we have used is

Solar panel: Solar plates, also known as solar panels or solar photovoltaic (PV) modules, convert sunlight into electricity. They are increasingly popular as a renewable energy source due to their ability to reduce reliance on fossil fuels and decrease carbon emissions.

Specification :-

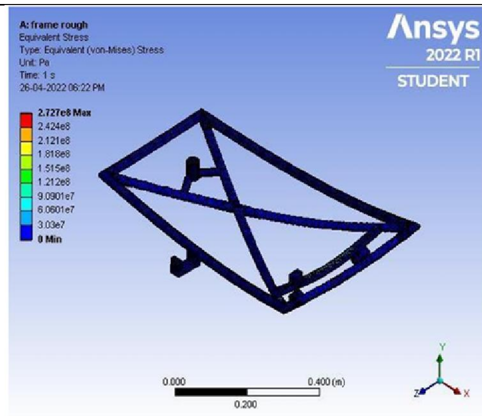
Specification on are at STC: 1000W/m2 Insolation AM 1.5,Cell

Temp 25°C

Name of company : Sun Aid Solar Energy LLP

Analysis

Since this is a mobility device all the force acting should be considered that would act during the actual function or the usage of the product. In this part we have carried out analysis of all various part using Software called ANSYS.*



FRAME Fig 6

Object name	geometry import
Part name	Frame
Material used	structural steel
stiffness behaviour	flexible
Analysis type	static structure
Geometry selected	8 faces , 4 vertices , 5 faces
Magnitude	1078 n
Direction	Downward direction in centre
Result – Total deformation	2.727e+008Pa

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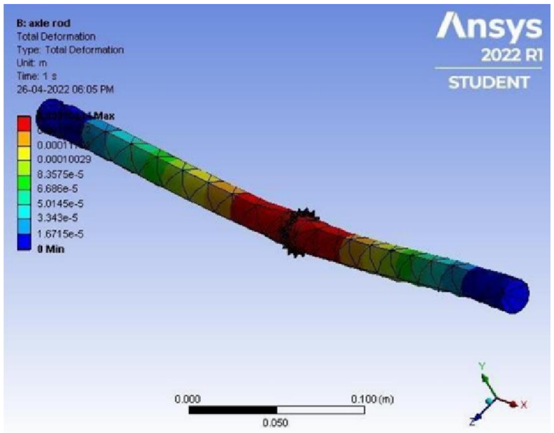
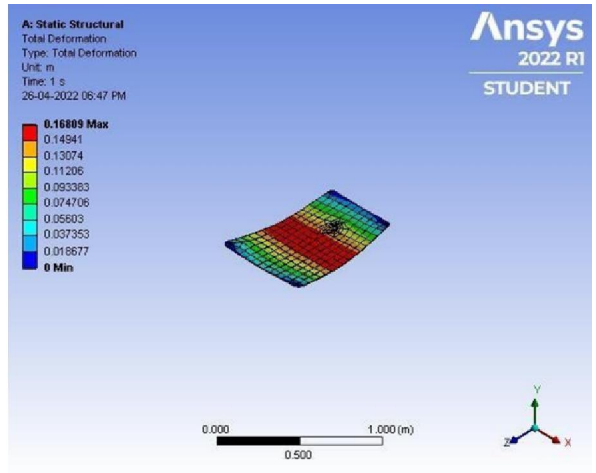


Axle Rod
Fig 7



Plywood
Fig 8

Object name	geometry import
Part name	Frame
Material used	structural steel
stiffness behaviour	flexible
Analysis type	static structure
Geometry selected	2 Faces
Magnitude	1078 n
Direction	Downward direction in centre
Result –Total deformation	1.5044e-004 m

Object name	geometry import
Part name	Frame
Material used	plywood
stiffness behaviour	flexible
Analysis type	static structure
Geometry selected	4 vertices , 1 face
Magnitude	1409 N
Direction	Downward direction in centre
Result –Total deformation	0.16809 m

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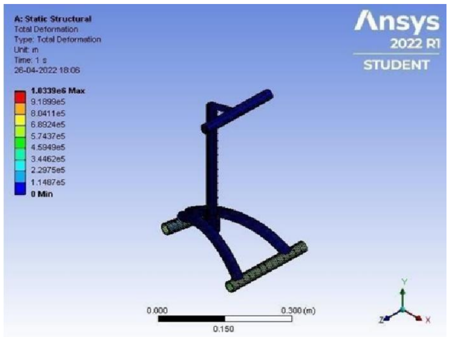
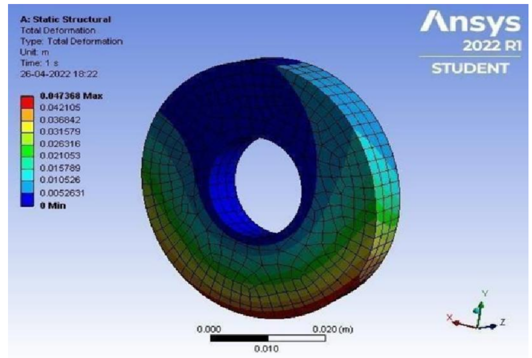


Handle Unit
Fig 9



PU Industrial Tires
Fig 10

OBJECT NAME	GEOMETRY IMPORT
PART NAME	HANDLE
MATERIAL USED	STRUCTURAL STEEL
STIFFNESS BEHAVIOUR	FLEXIBLE
ANALYSIS TYPE	STATIC STRUCTURE
GEOMETRY SELECTED	8 FACES , 4 VERTICES ,5 FACES
MAGNITUDE	1078 N
DIRECTION	FRONT DIRECTION IN CENTRE
RESULT – EQUIVALENT STRESS	2.E+003 PA

OBJECT NAME	GEOMETRY IMPORT
PART NAME	Tires
MATERIAL USED	PU INDUSTRIAL
STIFFNESS BEHAVIOUR	FLEXIBLE
ANALYSIS TYPE	STATIC STRUCTURE
GEOMETRY SELECTED	8 FACES , 4 VERTICES ,5 FACES
MAGNITUDE	1078 N
DIRECTION	FRONT DIRECTION IN CENTRE
RESULT - EQUIVALENT STRESS	6.e+006

Redesign

Redesign involved the addition of the power pack i.e. Battery unit and the Motor unit as well as the throttle on the handles.

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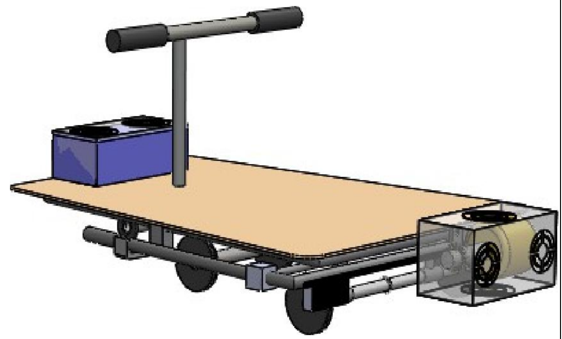
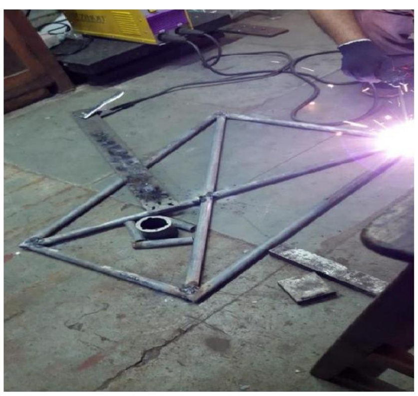
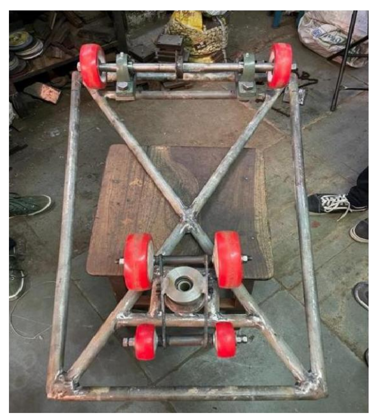
REDESIGNING

 Old Design Fig 11	 Revised Design Fig 12

Material and parts buying

We will buy the material from market or order any product when it to be need

Fabrication

Formation Of Frame	Wheel Attachment
Connecting all the galvanized and forming a structural frame using Argon Welding method.  Fig13	Placing and attaching PU industrial Tyres on Axle Rod.  Fig14

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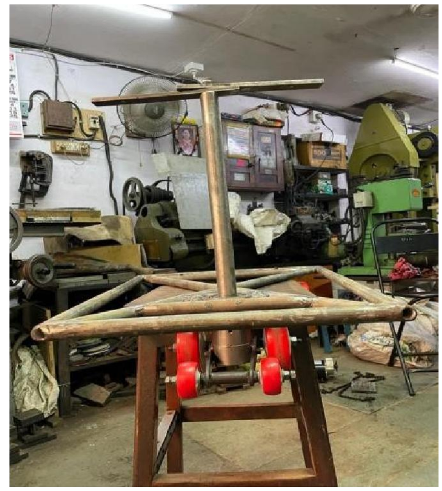
Fixing Of Handle Rod

Adding Rod for Handle into the Frame with help of Bearing.	
 Fig 15	 Fig 16

Attachment of all Brake, Electrical Components and Plywood.

Fig 17

G. Testing

Test the model weather it passes all the parameters or not.

III. LITERATURE REVIEW

PU-INDUSTRIAL-TIRES

1) Carlos F.Reveloa , Mauricio Correab , Claudio Aguilarc, Henry A.Coloradoa discussed that The type of economic model and its consequent increase in the demand of new cars has led in an incredible and uncontrollable amount of waste tires everywhere. Over 1.4 million of new tires are generated every year, and there are more than 4 billion tires in landfills worldwide. Besides the multiple solutions, which includes waste to energy, asphalts, concretes, and composites, among others, there is a need of more solutions that increase the circularity of materials and maximize its useful time. In addition, tire waste is not only a common source of mosquitos from stagnant water, which is a source of dangerous diseases; but also, is a common illegal practice, particularly in developing countries, the tire burning for the

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steel extraction that produces very hazardous pollution. Therefore, the handling of this problem is still far from a total solution, and thus, very diverse and innovative solutions are required.

Although most of the tires and tire waste are produced in China (with about 60 % of the total world production), USA and Europe, in developing countries, new problems appear, such as a poor waste management and old technology, weak environmental policies, and social issues (such as illegal tire burning). In the case of Colombia, the average annual consumption of tires is between 4.5 and 5.5 million, from which their waste, 72 % are treated by incineration, 17 % is hoarded and 6% have a craft disposition.

Tire waste has been successfully mixed with other polymeric materials, such as polypropylene, and polyurethane foams. Several investigations related to the study of rubber sheets, their properties, and applications were found. Ahmed, Nizami, and Riza 2014, developed natural rubber composites reinforced with marble sludge by compression molding. Lertloypanyachai and Thongsang have investigated rock powders acting as filler in natural rubber aiming higher mechanical properties in rubber-based floor tiles. Zaera et al. developed a polyurethane and rubber-modified epoxy resin as a potential adhesive layer to bind ceramic tiles with a metallic plate.

From an exhaustive analysis of the potential applications of the processing of this type of waste, a small company committed to the environment arises focused on the use and transformation of recycled materials “Eco Reproducts” has been created as result of this research. The company develops flexible floors from granulated rubber from tires and industrial surpluses. Designing efficient, innovative and ecological impact solutions for all types of environments: gyms, playgrounds, kindergartens, sports plaques, decorative spaces (indoor and outdoor), stables for horses, livestock, among others.

In this research, unlike the aforementioned, tiles from four different granulometries of rubber waste powders were made in combination with polyurethane resin, using a hot-press machine. The preparation of composite materials and the tests carried out are detailed, which include voltage, density, scanning electron microscopy, and thermo-gravimetric analysis. These materials contribute to the reduction of pollution generated by rubber residues, but also create new business opportunities for local people.

GEARED MOTOR:

A geared motor is a component whose mechanism adjusts the speed of the motor, leading them to operate at a certain speed. geared motor have the ability to deliver high torque at low speeds, as the gearhead functions as a torque multiplier and can allow small motors to generate higher speeds.

A geared motor can also be defined as a gear reducer because essentially, it is a combination of a speed reducer with a motor typically functioning as a gearbox, to reduce speed making more torque available.

Simply put, a gear motor is an electric motor coupled with a gearbox. In most cases, the addition of a gearbox is intended to limit the speed of the motor’s shaft and increase the motor’s output torque.

Gears transform shaft speed and torque at specific ratios, with minimum efficiency losses, which makes it possible to create the ideal output speed and torque with the addition of an appropriately sized and configured gearbox.

Gear motors use either AC (alternating current) or DC (direct current) power depending on the type of electric motor coupled to the gearbox. geared motor can be classified based on the motor they are paired with, including bevel, helical, hypoid, spur and worm gears.

Each of these gears have advantages and disadvantages.

For example, helical gears possess more torque capacity than spur gears, hence, generating less noise. Worm gears work efficiently in the low torque angel and are good for high speed reductions.

How can the functionality of gear motors be improved?

• Analyse and correct the mechanical noise levels by subjecting them to tests using frequency measurement equipment.

• The optimal torque measurement of starting torque, output torque and rated torque ensures proper transmission of the motion of the machine.

• Energy efficiency is an important factor to bear in mind, as the disposition of the gear train, the characteristics of rolling bearings enhance the performance across the entire system.

• Tests need to be carried out to measure the resistance, limits and the speed reducer service life.

BATTERY LI-ION

2.) John B. Goodenough* and Kyu-Sung Park discussed with the huge demands for the timely and efficient delivery of global information, information col-lection and transmission require a portable information-exchange platform for real-time response. Portable electronic devices (PEDs) including mobile phones, portable computers, tablets, and wearable electronic devices are the most promising candidates and have promoted the rapid growth of information processing and sharing. With the development and innovation of electronic technology, PEDs have been rapidly growing over the past decades.

Each cell of a battery stores electrical energy as chemical energy in two electrodes, a reductant (anode) and an oxidant (cathode), separated by an electrolyte that transfers the ionic component of the chemical reaction inside the cell and forces the electronic component outside the battery. The output on discharge is an external electronic current I at a voltage V for a time Δt. The chemical reaction of a rechargeable battery must be reversible on the application of a charging I and V. Critical parameters of a rechargeable battery are safety, density of energy that can be stored at a specific power input and retrieved at a specific power output, cycle and shelf life, storage efficiency, and cost of fabrication.

Conventional ambient-temperature rechargeable batteries have solid electrodes and a liquid electrolyte. The positive electrode (cathode) consists of a host framework into which the mobile (working) cation is inserted reversibly over a finite solid–solution range. The solid–solution range, which is reduced at higher current by the rate of transfer of the working ion across electrode/electrolyte interfaces and within a host, limits the amount of charge per electrode formula unit that can be transferred over the time $\Delta t = \Delta t(I)$.

Moreover, the difference between energies of the LUMO and the HOMO of the electrolyte, i.e., electrolyte window, determines the maximum voltage for a long shelf and cycle life.

The maximum stable voltage with an aqueous electrolyte is 1.5 V; the Li-ion rechargeable battery uses an organic electrolyte with a larger window, which increase the density of stored energy for a given Δt. Anode or cathode electrochemical potentials outside the electrolyte window can increase V, but they require formation of a passivating surface layer that must be permeable to Li^+ and capable of adapting rapidly to the changing electrode surface area as the electrode changes volume during cycling.

A passivating surface layer adds to the impedance of the Li^+ transfer across the electrode/electrolyte interface and lowers the cycle life of a battery cell. Moreover, formation of a passivation layer on the anode robs Li from the cathode irreversibly on an initial charge, further lowering the reversible Δt. These problems plus the cost of quality control of manufacturing plague development of Li-ion rechargeable batteries that can compete with the internal combustion engine for powering electric cars and that can provide the needed low-cost storage of electrical energy generated by renewable wind and/or solar energy.

SPEED CONTROLLER

3.) Prabha Malviya (PG Student) * , Menka Dubey(Sr. Asst.prof.) has discussed about the brushed DC motor which was invented in 1856 by Werner Von Siemens in Germany. Variable speed by armature voltage control was first used in the early 1930s using a system involving a constant speed AC motor driving a D.C. generator. The generator's DC output was varied using a rheostat to vary the field excitation and the resulting variable voltage DC was used to power the armature circuit of another DC machine used as a motor. This system was called a WardLeonard system after the two people credited with its development. The Ward-Leonard method of DC variable speed control continued until the late 1960s when Electric Regulator Company brought to market a practical, general purpose, static, solid state controller that converted the AC line directly to rectified DC using SCR (thyristor) devices. That technology was adopted by virtually all manufacturers and still is in use today. It is a very simple power control concept and uses the fewest number of parts possible to produce variable speed from an electric motor. Speed control means intentional change of the drive speed to a value required for performing the specific work process. Speed control is a different concept from speed regulation where there is natural change in speed due change in load on the shaft. Speed control is either done manually by the operator or by means of some automatic control device.

1) Armature control method.
2) Field control method.

It is used to influence the rotational speed of motors and machinery. This has a direct effect on the operation of the machine and is crucial for the quality and the outcome of the work. When drilling, different rotational speeds must be selected for different materials and for various drill sizes, and in pump installations, the throughput rates must vary, and a conveyor belt must be able to adapt its speed to the workflow. But even a fan motor in an industrial hall has to change its rotational speed and it must be customised to adapt to volume throughput change, according to the needs of the hall. This is where the electronic speed control comes into play. But this is only a small example taken from the wide array of applications for speed control in electric motors and machinery.

CHAIN

4.) Easter Dsouza, Siraj Sawant, Omkar Thakur, Bhushan Surve, Prof. Sachin Vanjari discussed about to plan the chain drive we want to concentrate on the heap on the machine and force of engine. Chain drive is perhaps the most basic part in mechanical power transmission framework and in generally modern hardware. It includes current plan, explicit material with thought of powers and burden and its mechanical properties. Tie drives are not difficult to update and reconfigure. In contrast with gears chains perform better under shock stacking conditions.

In contrast with belt drive they don't need strain on slack side, hence bearing burden is decreased. In chain drive working burden is spread over numerous teeth and cautious arrangement and legitimate oil are required.

The chain drives are generally utilized for high force transmission. From all chain roller has a positive drive. From estimations, it tends to be seen that for the determined sprocket to accomplish more speed than the primary shaft the number of teeth ought to be less then Driver sprocket. For chain material treated steel ought to be utilized for better yield strength and extreme strength.

SPROCKETS

5.) S. Thipprakmas conducted a study on sprockets, which are toothed wheels used in drive systems. The strength and wear resistance of these teeth are key factors. Traditionally, sprockets have been made using a method called hobbing, followed by heat treatment. However, an alternative method known as fine-blanking is gaining popularity among manufacturers. Fine-blanking can reduce the number of steps in production, which lowers costs and production time, while also enhancing the quality and consistency of the parts. This method allows for significant deformation, resulting in improved strength, hardness, and wear resistance. In this research, the hardness and wear resistance of fine-blanked sprockets were compared to those made through hobbing. The fine-blanked sprocket showed a unique microstructure with compressed and elongated grains, which contributed to its greater wear resistance compared to the traditional method. Interestingly, it was found that using low carbon steel instead of medium carbon steel for making these sprockets could cut material costs while also eliminating the need for heat treatment, further speeding up production.

Yong Wang focused on roller chain drives commonly used in gasoline engine timing mechanisms. These drives often face challenges, including polygonal action and meshing impacts that can affect performance. To address this, Wang developed a new sprocket tooth design aimed at minimizing these issues at high speeds. The design modifies the traditional involute profile to ensure that the distance moved by the chain matches the arc length of the sprocket, maintaining alignment with the chain's tight side. They also proposed an asymmetrical design for the sprocket teeth. A dynamic model of the engine timing system was created to analyze the chain's behavior under different speeds, showing that the new profile significantly reduces impacts and friction, leading to better stability.

Bahir H. Eldiwany conducted an experimental study on steel roller chains interacting with polymer sprockets to understand how load is distributed across them. This study assessed how factors like the elasticity of the material, tight-side and slack-side loads, and pitch differences impact performance. They constructed specialized machines to measure these loads and compared theoretical models to the experimental outcomes, providing insights into the load distribution dynamics in such systems. In summary, these studies focus on improving sprocket design and materials to enhance efficiency, reduce costs, and ensure better performance in mechanical systems like engines.

GALVANIZED PIPE

6.) John L. Clarke has discussed Galvanized steel reinforcing bars have been successfully used in several countries over the past 50 years (Australia, Bermuda, Netherlands, Italy, the UK, and the USA) and consumption is increasing. The main advantages of galvanized steel are:

•it delays the initiation of corrosion and cracking
•it has very good performance in carbonated concrete
•it tolerates higher chloride migration levels than uncoated steel
•it provides protection to the steel during storage
•it has longer life in cracked carbonated concrete than uncoated bar.

Hot-dipped galvanized steel is produced by dipping clean and fluxed steel into a bath of molten zinc. The layer formed on the surface of the steel usually consists of a thin outer coating of pure zinc on a series of layers of zinc/iron alloys with increasing iron content.

The performance of galvanized steel in concrete as reported in the literature (Andrade et al., 1995) is contradictory. Although it has been used successfully in practice, laboratory studies suggest that its performance would not be cost-effective. The factors behind this divergence of views, currently the object of discussion, are:

•the pH of the cement paste
•the bond between the reinforcing bars and the concrete
•chromate passivation of the galvanized steel
•the structure and thickness of the zinc coating
•the resistance of the zinc coating to corrosion induced by chloride ions

PLYWOOD

7.) Charlotta Harju has discussed in order to develop strategies for sustainable practices and to enhance the replacement of non- renewable materials with sustainable alternatives such as wood, it is essential to recognize the variables affecting consumers' quality perceptions. Despite this, there is still limited knowledge about the perceived quality of wooden building materials. Wood industry studies have to date approached quality mainly by investigating quality indicators related to the product or supplier, while overlooking the effects of the consumer characteristics on the quality perception process.

The purpose of this study is to fill this gap by implementing a systematic literature review of peer- reviewed articles published in international scientific journals during the 2000s using the "Scientific Procedures and Rationales for Systematic Literature Reviews" (SPAR- 4- SLR) protocol. Literature searches are implemented in two scientific databases (ISI Web of Knowledge and Scopus) to gather the material to be analysed according to two organizing frameworks (i.e., the TCCM framework and the Model of the Quality Perception Process).

Solar photovoltaic (PV)

8)Solar photovoltaic (PV) technology converts sunlight into electricity and is becoming increasingly popular around the world. From 2018 to 2019, global PV capacity grew from 483.1 GW to 580.2 GW, a 21% increase (IRENA, 2020). Asia leads in installed capacity, dominated by China (175 GW), followed by Japan (55.5 GW) and India (26.8 GW). Europe also has significant contributions, especially from Germany (45.9 GW), Italy (20.12 GW), and the UK (13.4GW).

Currently, PV technologies have efficiencies below 23%, highlighting the need for improvements (Alami et al., 2022). Performance is affected by factors such as solar radiation, temperature, and dust. While sunny desert regions can produce high energy, dust accumulation can hinder performance. Various studies have looked into the effects of dust and ways to manage it (Gupta et al., 2019; Darwish et al., 2015; Costa et al., 2016). Cell temperature significantly impacts PV output, as higher temperatures can decrease power generation. Effective cooling and heat management strategies are being explored to boost efficiency, with new combined cooling techniques emerging in recent research (Hasanuzzaman et al., 2016; Reddy et al., 2015). An updated review of these developments is important for advancing PV technology.

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IV. RESEARCH GAP

1. Limited Customization for Diverse User Needs

Gap: Most existing mobility devices offer limited customization options, particularly for users with unique physical or environmental requirements (e.g., elderly individuals, disabled veterans, or patients with specific mobility impairments).

Opportunity: There is room for developing a modular or customizable lift that can be tailored to individual user needs, whether in terms of size, load capacity, or functionality.

2. Lack of Lightweight and Portable Solutions

Gap: Many lower lift devices are bulky, heavy, and difficult to transport or store, particularly for home use or personal mobility.

Opportunity: A lightweight, foldable, or compact solution is needed to increase portability and ease of storage, especially for users who travel frequently or live in smaller spaces.

3. Energy Efficiency and Power Optimization

Gap: Current lower lift designs often neglect energy efficiency, particularly in motorized systems. This can result in high power consumption, leading to frequent recharging and short battery life.

Opportunity: Research is needed to develop energy-efficient actuation mechanisms, possibly integrating regenerative systems that can optimize power usage, extending battery life and reducing operational costs.

4. Lack of Smart Integration (IoT and AI)

Gap: Few mobility devices have embraced the potential of smart technologies, such as IoT, AI, and data analytics, which could enhance user experience through real-time monitoring, diagnostics, and predictive maintenance.

Opportunity: There is a gap in designing a connected mobility solution that could offer remote control, performance monitoring, and user-specific adjustments based on real-time data, improving both usability and maintenance.

5. Environmental Impact and Sustainability

Gap: Most lower lift mobility devices are manufactured using non-recyclable materials or waste-intensive processes, which contribute to environmental degradation.

Opportunity: There is a significant gap in eco-friendly manufacturing practices and materials. Research is needed to create sustainable, low-waste, or recyclable alternatives in both the design and production phases, addressing environmental concerns.

6. Ergonomics and User Comfort

Gap: Many lower lift devices focus heavily on functionality but lack ergonomic design features that enhance user comfort during operation, particularly for prolonged use.

Opportunity: Research in human-centered design can bridge the gap by improving the ergonomics of the lift, enhancing comfort for users with mobility limitations, and reducing physical strain during usage.

7. Cost-Effectiveness for Low-Income Users

Gap: High-end lower lift mobility devices are often expensive, making them inaccessible to lower-income individuals, particularly in developing regions.

Opportunity: There is a gap in affordable, cost-effective designs that maintain high functionality and safety while being accessible to economically disadvantaged groups. Research into the use of recycled materials and simplified manufacturing processes could help fill this gap.

8. Safety Features and Reliability

Gap: Many mobility devices still lack advanced safety mechanisms such as auto-braking, tilt detection, or emergency stop features, posing risks for users with limited motor control or in unstable environments.

Opportunity: Research on integrating smart safety systems and fail-safes can ensure better reliability and user protection, especially for individuals with severe mobility impairments or in high-risk scenarios.

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V. NOVELTY

1. Modular Design

Idea: Create a modular lower lift system that can be adapted for different users and environments, such as hospitals, homes, or outdoor settings.

Novelty: Modular components allow easy customization, repair, and scalability, making the device adaptable for various use cases.

2. Use of Lightweight, Durable Materials

Idea: Implement advanced materials like carbon fiber composites or high-strength aluminum alloys to reduce weight while maintaining structural integrity.

Novelty: Lightweight materials will enhance portability and ease of use, making it more accessible for elderly or disabled users.

3. Energy-Efficient Actuation

Idea: Design an energy-efficient actuation mechanism, possibly incorporating electric motors, hydraulic lifts, or regenerative braking for energy recovery.

Novelty: Using energy-efficient systems reduces power consumption, making the device eco-friendly and enhancing battery life for motorized versions.

4. Smart Connectivity and Control

Idea: Integrate IoT (Internet of Things) features, enabling users to control the lift via a smartphone app, voice commands, or gesture control.

Novelty: Smart mobility devices with real-time diagnostics, remote monitoring, and safety features would be highly innovative.

5. Compact Folding Mechanism

Idea: Incorporate a foldable design for easy storage and transportation.

Novelty: Creating a compact and foldable lower lift mobility device enhances user convenience, especially for home use or transportation in smaller vehicles.

6. Ergonomic and Aesthetic Enhancements

Idea: Design the lower lift with ergonomics and aesthetics in mind, focusing on user comfort, ease of handling, and visually appealing design.

Novelty: Combining function with form can set your design apart, making it not only practical but also visually appealing and user-friendly.

7. Integration of Safety Features

Idea: Add safety features like auto-braking, tilt sensors, and emergency stop systems to prevent accidents.

Novelty: These intelligent safety features will make the device safer for users, especially in dynamic environments like hospitals.

8. Eco-Friendly Manufacturing

Idea: Focus on using sustainable, recyclable materials and waste-minimizing processes in manufacturing.

Novelty: Reducing the environmental impact through sustainable design and manufacturing processes can appeal to eco-conscious consumers and set your product apart from competitors.

9. User-Driven Customization

Idea: Allow users to personalize the lift's dimensions, load capacity, or features based on their needs, through an easy-to-use interface.

Novelty: Offering customization through 3D printing or modular add-ons enhances user satisfaction and provides tailored solutions for specific requirements

10. Low-Cost and Accessible Solution

Idea: Focus on cost-effective design and manufacturing methods, such as using scrap or recycled materials, to make the product more affordable.

VI. CONCLUSION

The designed Energy Generation System successfully integrates wind, hydro, and solar power to provide a sustainable and efficient hybrid energy solution. By utilizing a vertical-axis wind turbine, a Pelton hydro turbine, and a 12V solar panel, the system ensures continuous power generation in diverse environmental conditions. The combination of these renewable sources enhances reliability and efficiency, making it suitable for off-grid applications and remote areas.

The project demonstrates the feasibility of hybrid renewable energy systems by efficiently combining different power sources into a single storage and distribution unit. The use of a 12V battery and AC-DC converter ensures stable power output for various low-power applications like charging mobile devices and LED lighting.

Although challenges such as weather dependency, initial cost, and system integration exist, the project highlights the potential for further advancements in renewable energy solutions. Future improvements could focus on higher efficiency components, automation for seamless power switching, and increased energy storage capacity.

This project serves as a step toward a greener and more sustainable energy future, reducing reliance on fossil fuels and promoting environmentally friendly power generation.

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