

Design of Rocking Chair for Energy Generation Purpose

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ABSTRACT

This paper mainly focuses on the design of rocking chair for energy generation purpose. Energy plays key role in daily life to satisfy the needs. Technology development is gradually increasing day by day. The traditional method of energy consumption is getting down due to high-energy demand. In order to satisfy the need of energy, the new method of energy consumption technique is discussed in this chapter.

KEYWORDS: energy generation, rocking chair mechanism and ratchet and pawl mechanism

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I. INTRODUCTION

Energy is the main driving force of recent societies, generation and utilization of energy are essential for socioeconomic development. Per- capita energy consumption levels are typically thought of an honest measure of economic development. In recent years, energy inadequacy has become a heavy downside because of depletion of non-renewable energy sources, increasing population, economic process of energy intensive economic development, environmental pollution, and warming. In recent years, there are several attention-grabbing developments within the field of human power conversion.

For this, one can use human energy by the chair mechanism of an individual sitting on a seat, housed within an outsized wheel, inside another wheel (rollers / balls placed in between the wheels) to generate electricity. The electricity generation plays vital role in the storage and future use based on the demand. When sizable amount of kids plays in a very

college playground, a part of the facility of their play will usefully be controlled leading to vital energy storage.

This stored energy will then be reborn to electricity for powering basic, low power appliances within the college like lights, fans, communications instrumentality, and so on. The method provides a low-cost, low resource means of generation of auxiliary electric power, especially for use in developing countries. In this work, human energy is utilized completely and converted to the electrical energy using the alternator. The future generation can live without less disease and can lead the life in both healthier and also in happy way.

Energy need of today's modern world is growing day by days because of consumption of some or larger extent or amount of growing population. Technology grows day by day with new and unbelievable ideas, products and to enhance the lifestyle of people day by day based on the growing world.

Technology mainly focuses on the automation, for automation energy generation only helps to move forward safer and in successive way. For reduction of energy scarcity, this works supports human to use their working energy in useful way. This work can provide several blessings like complete body calculate, complete and break less offer of energy, energy generation for the future works and etc. can be achieved easily.

This work mainly concentrates on the energy generation with the human total result. This helps to scale back the physical structure issues simply and additionally with less effort. The energy generation depends on the human capability to swing within the chair. The human effort are going to be converted to energy generation exploitation the generator setup and with the gear pulley assembly.

The chair mechanism can facilitate to provide the energy supported the human's swinging motion to attain the energy generation some mechanisms are to be used. They are mechanism used in the work are discussed below.

1.1. Energy Generation

Electricity generation is that the method of generating electrical power from sources of primary energy. Electricity is not freely on the market in nature, therefore, it should be "produced" (that is, remodeling alternative kinds of energy to electricity).

For utilities within the electrical power trade, it is the stage before its delivery (transmission, distribution, etc.) to finish users or its storage (using, as an example, the pumped-storage method).

Electricity is most frequently generated at an influence plant by mechanical device generators, primarily driven by heat engines oxyacetylene by combustion or nuclear reaction however conjointly by alternative means that like the kinetic energy of flowing water and wind. Alternative energy sources embrace star photovoltaics and geothermic power.

1.2. Energy Generation Methods

Several basic strategies exist to convert alternative sorts of energy into power. Utility-scale generation is achieved by rotating electrical generators or by electrical phenomenon systems.

1.2.1. Generators

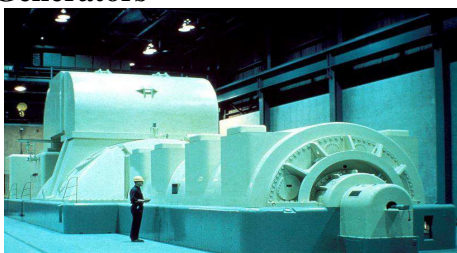


Figure 1.1 U.S. NRC image of a modern steam turbine generator (STG)

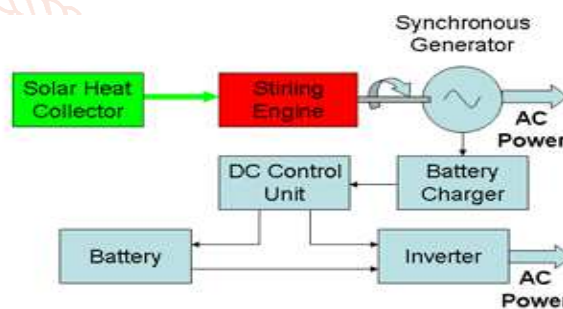
The figure 1.1 shows U.S. NRC image of a modern steam turbine generator (STG). Electric generators remodel mechanical energy into electricity. this is often the foremost used type for generating electricity and relies on Faraday's law.

It is seen through an experiment by rotating a magnet among closed loops of conducting material (e.g., copper wire). the majority industrial electrical generation is finished victimisation magnetic attraction induction, within which energy forces a generator to rotate.

1.2.2. Electrochemistry

The figure 1.2 shows the energy generation using thermal energy. Electrochemistry is the direct transformation of chemical energy into electricity, as in a battery.

Electrochemical electricity generation is vital in transportable and mobile applications. Currently, most chemistry power comes from batteries.



Small Scale Electric Power from Solar Thermal Energy
Figure 1.2 Energy Generation using thermal energy

Primary cells, like the common zinc-carbon batteries, act as power sources directly, however secondary cells (i.e. reversible batteries) area unit used for storage systems instead of primary generation systems.

Open electrochemical systems, called fuel cells, is wont to extract power either from natural fuels or from synthesized fuels. diffusion power may be a chance at places wherever salt and H₂O merge.

1.2.3 Photovoltaic effect

The figure 1.3 shows the energy generation using the solar energy. The electrical phenomenon result is that the transformation of sunshine into power, as in star cells.

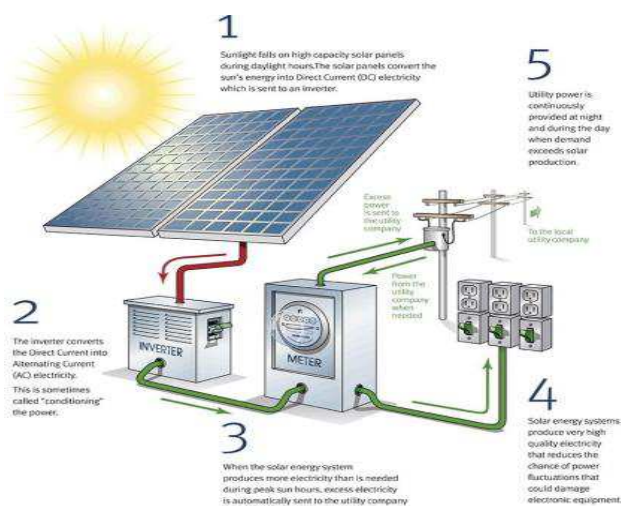


Figure 1.3 Solar Energy Generation

Photovoltaic panels convert daylight on to DC electricity. Power inverters will then convert that to AC electricity if required. Though daylight is free and abounding, alternative energy electricity continues to be sometimes dearer to supply than massive scale automatically generated power because of the value of solar panels.

1.3. Energy generation using the chair mechanism

In this work, energy generation is completed exploitation the chair that is housed within an outsized wheel, inside another wheel (rollers / balls placed in between the wheels). Human exercise is that the key issue during this work to supply energy incessantly for future purpose. The mechanism in the main utilized in this work square measure chair and ratchet-pawl mechanisms. This work provides the continual energy by the wholesome exercise of individual. By the housing of the chair within the wheel, the protection is extremely high whereas doing the exercise. The generator plays major role in changing and sending energy to the battery for storing and exploitation the energy for future generation purpose. The wheel and simple machine assembly square measure wont to transfer the motility energy to generator to convert it to current. during this work, continuous energy is made for the long run wants. this can satisfy the fundamental wants in emergency things conjointly. Continuous provide of energy are going to be achieved during this work. The energy generation potency in the main depends on the human calculate capability during this setup. The chair is that the key issue during this work to achieve enormous energy continuously.

1.4. Mechanisms used in the Work

The mechanisms used in the work are discussed.

1.4.1. Rocking Chair Mechanism

In this work, the rocking chair mechanism is the motion of the wheels with respect to the motion of the

chair oscillation. When the chair starts oscillating, the wheel can move in dextrorotatory direction. The wheel moves in dextrorotatory direction by the freewheel mechanism exploitation ratchet and stop setup.

1.4.2. Ratchet and Pawl Mechanism

In this work, once the chair starts oscillation, the click starts to maneuver the wheel in dextrorotatory direction. supported this movement, the outer wheel starts to rotate in dextrorotatory direction. The outer wheel are going to be connected with the wheel-pulley assembly. supported the rotation, human energy is transferred from the wheel-pulley assembly victimization outer wheel are going to be transmitted to generator. The generator can convert and transmit energy to battery.

The on top of mechanisms play important role to born-again the human energy to energy generation for future generation. supported the mechanisms, gear-simple machine assembly and generator setup, the energy generation of the total system is achieved and it's hold on within the battery for usage in emergency situations and also for the future purpose.

The energy generation based on the swinging motion helps to have the continuous energy generation. By this work, many advantages will be achieved by human beings.

1.5. Need of the work

Electricity is the source to light up the life of humans. Without electricity, whole world will get stopped to run daily life. Energy generation method using traditional techniques are getting down due to the usage. In this current situation, the new method of energy generation is required to reduce the energy scarcity. The energy scarcity plays important role which is mainly arrived due to increment of human population with usage. Traditional method of energy generation is getting less efficient based on performance. The power production is getting incremented day by day based on the usage. Wastage of energy plays important role in this scarcity. If this continues means, the future generation will suffer to satisfy the basic needs.

1.6. Benefits of the Work

Some of the advantages of the works are:

- Burning of unwanted calories is achieved.
- Energy generation for the upcoming needs is achieved
- Reduce the amount spent for any treatment to make human body healthier.
- Continuous provide of energy for satisfying the commodities that need energy.

- This helps to reduce the energy generation problems from the energy stations for the city or any surroundings.
- Day to day energy consumption can be done and utilized with less effort.
- Calories burnt are seen by using simply with this add the shape of energy generation.
- The energy generation setup is mainly working on the human swinging motion, alternator setup with some precaution measures.

The above points mentioned are the benefits mainly achieved using the work.

II. LITERATURE REVIEW

Alejandro Rodríguez-Molina et al [1] (2020) discussed about an indirect adjustive management supported on-line multi-objective improvement is projected to regulate the speed of the four-bar mechanism Associate in Nursing increase its life by smoothing the control action underneath the consequences of uncertainties. During this work, a multi-objective improvement downside is explicit and so resolved by the novel on-line Hypervolume-based Differential Evolution (O-HV- MODE) in such the simplest way that many promising model parameter configurations are found in period, with completely different trade-offs among the performance demands. The projected management is valid through experimental checks and therefore the responsibility of the results with the ninety-nine Confidence Interval test. In addition, the proposal is compared with progressive linear and non-linear management approaches.

Amir Hosein Sakhaei et al [2] (2017) discussed about an approach to create compliant ratchet-like mechanisms that take advantages of multi-material 3D printing technology and to replace traditional mechanisms. This work allows the elimination of springs and international movement of the dog or gear that generally exist in classical ratchets. In this, performed additional studies on however material and geometrical parameters have an effect on the mechanical performance of the projected mechanism.

M.S. Anoop et al [3] (2020) described about the failures and optimization in the shaft design of alternator in rail coaches. In this, the stress concentration is evaluated and the reason for the breakage is also found. In this article, the reasons found out for shaft breakage is mainly by the fillet region behind the taper for pulleys and also by the tool materials used in the shaft.

Ayneendra B et al [4] (2017) said about the new method of producing energy through the swinging

motion. In this work, the power is generated by employing a swing in such the way that once it swings the energy is generated and it's born-again into electricity by a electric switch and is hold on in an exceedingly battery. During this new and different methodology of energy generation mistreatment the swinging motion is performed. The energy is totally used for energy generation directly during this work. The battery unit is employed to store the complete electrical energy produced using mechanical energy. The energy utilization and storage are very high in this method.

M.A. Bek et al [5] (2020) described motion of an excited damped spring pendulum. The governing system of motion is derived using Lagrange's equations taking into consideration the presence of external forces acting on the investigated system. Concluded that this work is mainly used in the fields of shipbuilding, submarines and engineering machines which have damping to deal with vibrations.

Bianca Rodrigues de Oliveira et al [6] (2020) described the assessment of diagnostic sensitivity of body mass index (BMI) to sight avoirdupois in line with totally different cut-off points so as to classify a high body fat proportion (%BF) in adolescents and young adults. In this work, the obesity level for adults and young adults are evaluated according to the body mass index.

K. Durkopp et al [7] (1993) described about the interrelationship between wear and friction in the free wheels. This work addresses the influence of the specific friction factor on the design and functionality of such coupling devices. The samples employed in these tests shows wear patterns which are typical in free wheels.

Gokul S P et al [8] (2016) described about a new method for human power conversion based on children's play on playground swing. The power controlled are often used as AN auxiliary or back-up supply for electricity, particularly in developing countries. A swing has been designed and developed and experimental results area unit obtained that illustrate the sensible effectiveness of electricity generation. During this work, the human energy is born-again to current fully exploitation bridge rectifier and battery. This work is often enforced at numerous parks, play homes, faculties etc. will actually lower down the load on main grid so serving to saving electricity.

Jiaying Zhang et al [9] (2016) described about a simple good structure model to analyze the reconfiguration of a four-bar mechanism through

space connections. A reconfiguration method is used to investigate the behaviour of a more realistic elastic smart structure model.

Jing Zhang et al [10] (2018) discussed about the stress concentration to be avoided and to increase the rotational angle of flexure joint. In this, properties of flexure joint are evaluated to achieve rotational motion. Finite element model is established to calculate the stress, deformation, torque.

Juan Vicente Avelar et al [11] (2012) described about the Play Park Human Powered Generator venture tends to different methods of producing power. More in particular, this venture involves the plan and development of the Swing Power Generator to give electrical force from mechanical energy. The swing generator will in the end be utilized as a component of the human- fueled generators used in the DC House venture. A swing generator model was worked for this venture, which exhibits the achievability of its utilization for electrical force.

Juntakan Taweekun et al [12] (2018) described that energy need of today's world is growing day by day because of consumption of larger extent of electricity due to growing population. Project is about energy generation using swing mechanism. In this work, new method of energy generation is described using the swinging was described. In this human energy is completely utilized to generate the energy to satisfy the future needs. The technique gives a minimal effort, low-asset methods for power age, contamination free framework, DC yield can likewise be accomplished, upkeep is simple particularly for use in agricultural nations. The prototype can be installed in parks, schools, picnic points and homes. The electricity produced can be efficiently used to light the places described above.

Lakshya Shrivastava et al [13] (2020) described about the the construction and designing of the system which is being analyzed by finite element analysis method and designed by considering all safety conditions according to the vehicle used. The mechanism calculations area unit made public by the assistance of diagrams illustrated and also the finite part associate analysis is carried to review an assortment of stresses in wheel and ratchet.

Liang Zhao et al [14] (2020) described about the comparison made between renewable energy sources like wind, photovoltaic (PV), and concentrating solar power in North African region to solve the energy demand. Furthermore, packing sun-based force in North African district to understand the energy interest. The outcomes show that environmentally friendly power joined with power age, including the

CSP mode, can improve dependability of the force supply and decrease the force diminishing rate. In this, an ideal environmentally friendly power age arranging model was set up and applied to design the force sizes of three sorts sustainable power age in Morocco, Egypt, and Tunisia through the time arrangement creation recreation method.

Priyesh Pradeep Revankar [15] (2017) said about the deltoid linkage is a kind of four bar linkage component in which the length of contiguous connections are equivalent. At such condition when one of the shorter links is fixed, then crank-crank or double crank mechanism is obtained. It means one shorter and one longer link acts as crank and another longer link as coupler between them. Thus, when longer link is rotated once, shorter link completes two rotations and when shorter link is rotated twice, longer link completes only one rotation. The main purpose of this research is to analyze the motion of deltoid mechanism and determine what type of motion does it transmits. As no research has been done before on such mechanism this analysis is carried out manually, i.e., by observing and drawing the angle of rotation of both the cranks with respect to each other. The model of deltoid mechanism is drawn by using CATIA V5R19.

Rameshwar Kadu et al [16] (2017) described about however we will convert apparatus motion of swing into current. Swing is generally used by children for playing in parks & playgrounds that will produce electricity during its use. During swinging pendulum movement of shaft moves its movement to flywheel. This turning movement of flywheel is moved to low RPM generator which produces power in little scope. On the opposite side of shaft pulverizing system is associated, which can be utilized to squash plastic waste gathered in the recreation center or playground.

A. Samson [17] (1980) described the conditions of movement of a free- swinging compound (physical) pendulum were coordinated to acquire an overall answer for the slipped by time as a geometrical fundamental. The last was diminished to Jacobian elliptic elements of the main kind, which were then comprehended by customary strategies for complete and deficient integrals. Applying the technique created to a summed-up pendulum portrayed by its level of compounding, the time of its swaying while in frictionless movement for any point of dispatch was resolved. The level of compounding of the pendulum significantly affected its time of swaying. This was indicated graphically as the variety of a dimensionless time proportion with change in point of dispatch for different levels of compounding. Five explicit instances of the time periods of a compound

pendulum were examined and arrangements got. The overall condition for the past season of free-swinging movement of a straightforward (numerical) pendulum, dispatched from any position and its period of 13 oscillation were additionally decided.

Sekiya Koike et al [18] (2019) described this examination proposed a technique to evaluate immediate and backhanded impacts of the joint force contributions to the speed-producing instrument of a swinging movement. Direct and precise increasing velocities of all sections inside a multi-connected framework can be communicated as the amount of commitments from a joint force term, gravitational power term and movement subordinate term (MDT), where the MDT is a nonlinear term comprising of radial power, Coriolis power and gyroscopic impact second segments. Direct impacts result from rakish increasing speeds prompted by a joint force at a given moment, though aberrant impacts emerge through the MDT actuated by joint forces applied before. These two impacts were evaluated for the kicking aspect leg throughout a rugby football kicking. The MDT was the largest supporter of the foot focus of gravity (CG) speed at ball contact. Of the weather in charge of manufacturing the MDT, the immediate and backhanded impacts of the hip flexion-augmentation force throughout each the flight stage (from the last kicking foot take-off to assist} foot contact) and also the ensuing support stage (from help foot contact to ball contact) were important supporters of the foot CG speed at ball contact. The roundabout impact of the lower leg plantar dorsal flexion force and the immediate impact of the knee flexion-expansion force during the help stage demonstrated the biggest positive and negative commitments to the foot CG speed at ball contact, individually. The proposed technique permits the distinguishing proof of which individual joint force tomahawks are vital and the timings of joint force effort that are utilized to produce a rapid of the distal purpose of a multi-connected framework.

Jiaying Zhang et al [19] (2020) described that to identify the relationship between the body mass index and body fat composition with foot arch among osteoarthritis patients.

Y. Tao et al [20] (2017) discussed Human-induced wake ow attributes and its effect on molecule re-scattering from the floor was 14 investigated by performing CFD recreations of a moving warm puppet model. The puppet moved with practical kinematic movement which included swinging arms and legs. This was performed utilizing dynamic-lattice which refreshed the matrix with each time step to speak to the puppet movement. The wake stream

and liquid elements created from three strolling speeds (0.8m/s, 1.2m/s and 1.8m/s) were looked at. Molecule transport from the floor and its re-scattering was followed by the LaGrangian approach. The outcomes demonstrated that the owed had a solid reliance on the strolling movement. For instance, the ow behind the body demonstrated a downwash ow beginning from the head, at mid-tallness the ow followed the puppet, and at the leg and feet, there was slight upwards ow. At the front of the body, ow smoothes out indicated the ow was pushed out and was pulled back around the body into the wake. These ow designs gave the premise to molecule re-suspension from the floor and scattering through the air. After the puppet quit strolling, the wake proceeded with advances and disregarded the puppet body. At the point when the wake force disseminated, warm tuft impacts became critical which affected the airborne particles to spread after some time. The molecule fixation entering the frontal zones of the body during the strolling was assessed to show the degree of inhabitant's presentation to impurities.

2.1. Summary of Literature

Based on the above literature surveys, the alternate energy generation methods are studied. By this the energy generation can be done using new method apart from traditional approach. By this, human energy will be regenerate to energy generation purpose. From the on top of literature review, the assorted strategies of energy generation are studied.

2.2. Problem Identification

Based on literature review collected, the main problems identified are

- Lack of storage of energy for next generation and to reduce the human weight through complete workout
- Converting the human effort to a reasonable resource in order to share and store it for future needs.
- Usage of the preserved energy can be used based on the needs in domestic commodities
- Reduce the human being weight in a simple and also in complete full body workout without side effects

2.3. Objective of the Work

The objective of the work is to

- To increase the usage of stored energy in the useful manner for future generation.
- To reduce the human weight through a complete body workout.
- To convert the human work to a valuable resource for future needs.

- To reduce the usage of traditional method of energy generation.
- To satisfy the basic and emergency needs.

III. METHODOLOGY

Figure 3.1 shows flowchart of methodology used in this work.

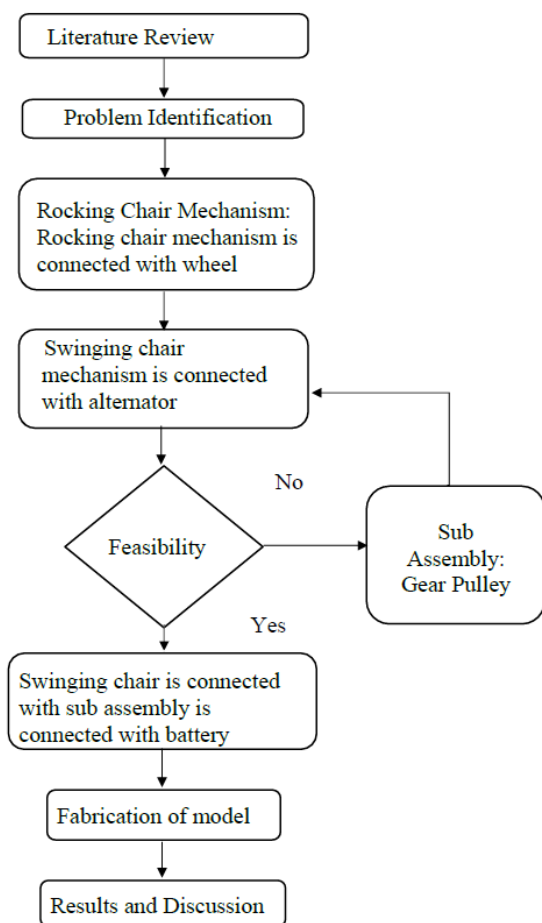


Figure 3.1 Methodology

3.1. Formulating a Problem

Energy generation plays a key role in the technological world to satisfy the needs. Now-a-days, energy scarcity takes place frequently due to the higher usage of energy by human regularly for productive and unproductive work. Review of literature conducted regarding the energy generation and its methods. Based on the review, some traditional method of energy generation is getting less efficient due to the energy usage and wastage done by human.

3.2. Ideation

Based on the review of literature, the new method of energy generation using rocking chair by human is formulated. By this method, the energy generation will be continuous, proper and also to satisfy the basic needs without looking for the external/traditional energy generation. This method is safe, secure and less costly. This method is less hazardous to the environment. This method will satisfy energy usage and storage. In this method, human energy is

transformed to electrical energy without wastage. By this method, generation and storage of energy is very high with less effort and cost. This method is useful for both basic needs and emergency needs.

3.3. Conceptual Design & Simulation

Based on the review of literature, the design of rocking chair for energy generation is formulated. In this phase, the design of rocking chair is done using the principle of Product Design. First, the chair is designed using the human body mass index. The chair is mounted on the roller support. The roller support is assembled within the inner support wheel. The inner support wheel is used to guide the chair mounted in roller support to oscillate in both forward and reverse direction. Ratchet and pawl is mounted outside the inner support wheel to rotate the outer wheel in dextrorotary direction. By this method, energy scarcity will be reduced effectively and easily. The energy generation are achieved with less effort and while not the assistance of external things.

3.4. Feasibility Check

The whole design of chair with wheel will be assembled with gear pulley assembly and also with the alternator. The feasibility study will be conducted based on the design of rocking chair mechanism connected with gear pulley assembly and also with the alternator. If it's possible then, the rocker mechanism connected with gear machine assembly and conjointly with the generator is connected with the battery. If it is not feasible then, gear pulley assembly and the alternator setup will be analyzed and designed based on the rocking chair mechanism.

3.5. Analysis

In this, the analysis of the model will be proceeded. Based on the analysis result, the process of fabrication will be proceeded after the modeling and simulation of the assembly model.

IV. Design of rocking chair model

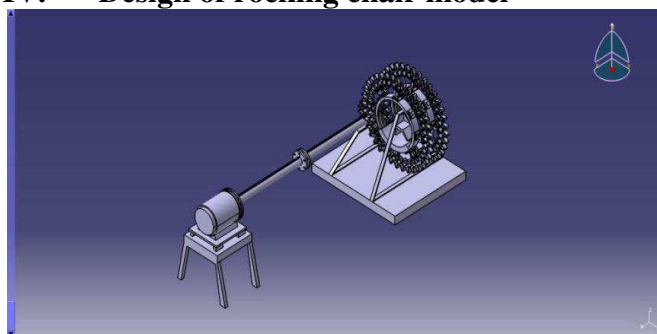


Figure 4.1 Assembly of the Model

The figure 4.1 shows the assembly of the energy generation using rocking chair model. The main purpose of the work is to

- Give a complete workout to human body in order to lead a healthy and safe life.

- Conversion of the physique exercise to supply the energy for the domestic desires for the long run functions.
- The epitome model is intended supported the flesh mass index to own safety exertion with less effort.
- The electrical energy generation will help to reduce the laziness of human in future and production of energy will increase simultaneously based on the workout.

The assembly model main comprises of inner wheel, roller with the chair, inner support wheel, outer support wheel, outer wheel.

The below figures show the inner wheel, roller with the chair, inner support wheel, outer support wheel, outer wheel models of respectively.

4.1. Parts in the Assembly

The parts in the assembly are

- Guide wheel,
- Roller Support with Chair,
- Clamp,
- Ratchet and Pawl
- Outer Support Wheel
- Outer Wheel
- Stand
- Outer wheel to transmit the rotation
- Shaft
- Alternator
- Alternator Stand

4.1.1. Guide Wheel

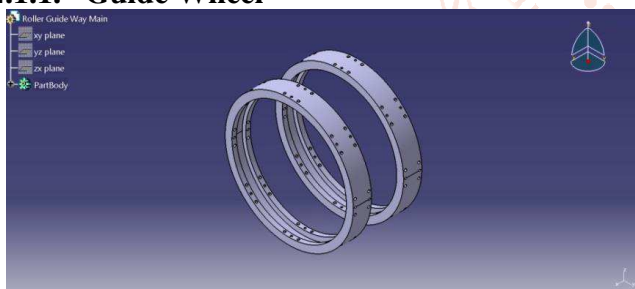


Figure 4.2 Guide Wheel 3D Model

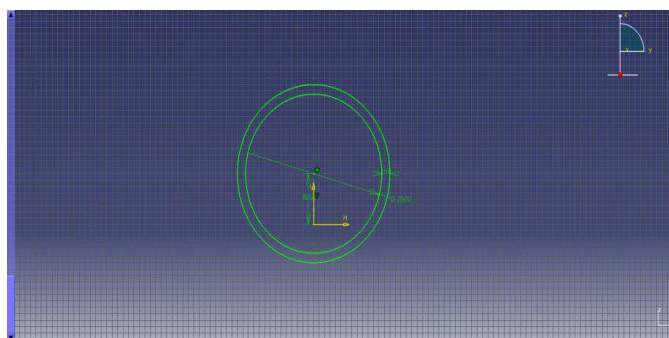


Figure 4.3 Guide Wheel 2D Sketch

The above figures 4.2 and 4.3 are the 3D model and sketch of the Inner Wheel. The inner wheel is called as guide wheel and used to guide the chair with the

roller support. The guide wheel is fixed using the stand.

4.1.2. Roller Support with Chair

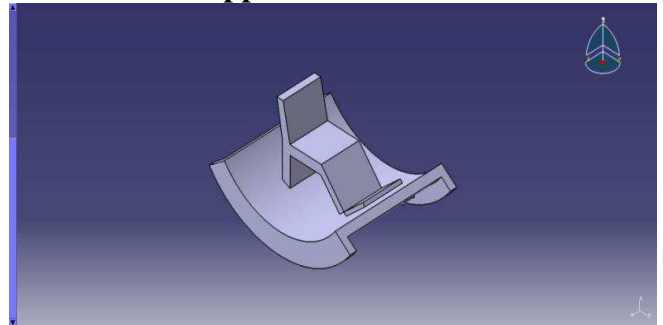


Figure 4.4 Roller Support with Chair 3D Model

The above figure 4.4 shows the: Roller Support with Chair 3D Model. The above model is mounted on inner wheel. The model starts swinging for 400 in swinging directions. Based on the swinging motion in clockwise direction, the ratchet and pawl moves in clockwise direction.

4.1.3. Clamp

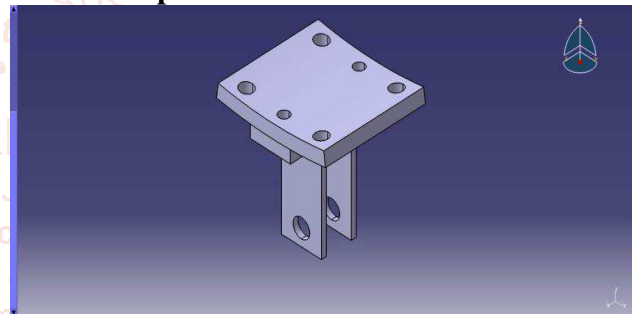


Figure 4.5 Clamp 3D Model

The above figure 4.5 shows the 3D model of the clamp. The clamp is attached with the roller guide. It is used to hold the ratchet and pawl to stop the slippage.

4.1.4. Ratchet and Pawl

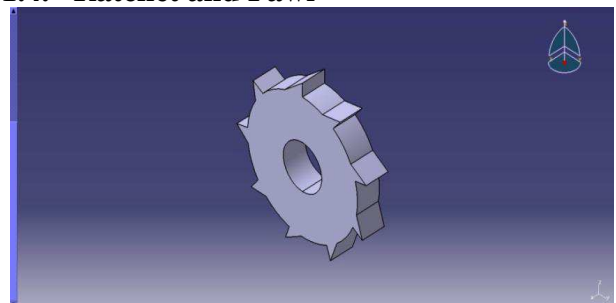


Figure 4.6 Ratchet and Pawl in 3D Model

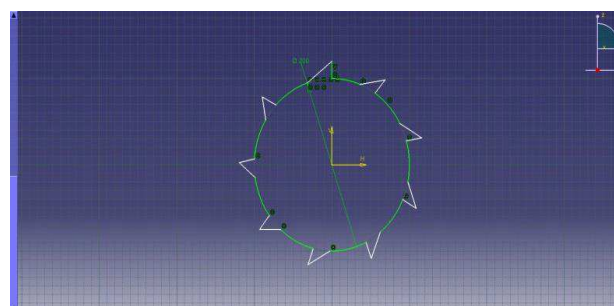


Figure 4.7 Ratchet and Pawl in 2D Sketch

The above figures 4.6 and 4.7 are the 3D model and sketch of the Ratchet and Pawl Wheel. The ratchet and pawl wheel rotates based on the swinging motion. The ratchet and pawl wheel is connected with the clamp.

Based on the clockwise motion swinging, ratchet and pawl makes the outer support wheel to rotate in clockwise direction. During reverse motion, the ratchet and pawl slips by that the outer support wheel will not rotate.

This is mainly used to restrict the counter clockwise motion of the outer support wheel.

4.1.5. Outer Support Wheel

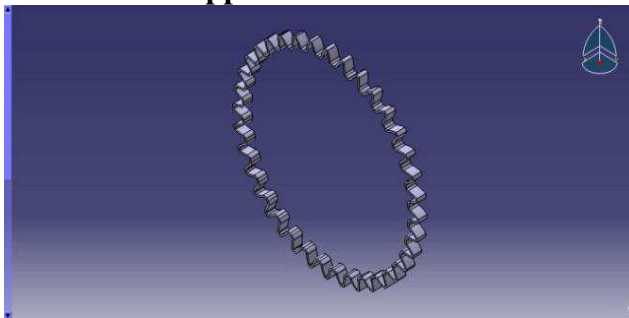


Figure 4.8 Outer Support Wheel in 3D Model

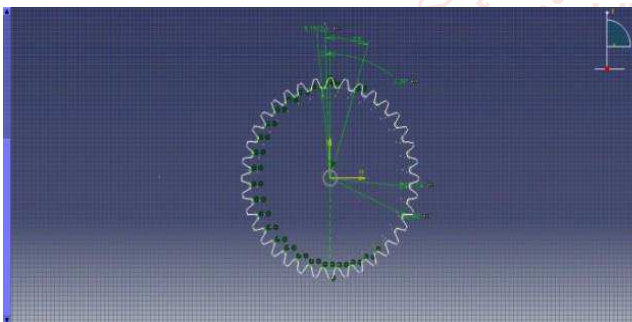


Figure 4.9 Outer Support Wheel in 2D Sketch

The above figures 4.8 and 4.9 are the 3D model and sketch of the Outer Support Wheel. The outer support wheel is connected with the ratchet and pawl wheel is connected in order to rotate in clockwise direction only. By the clockwise motion, the outer wheel rotates in clockwise motion.

4.1.6. Outer Wheel

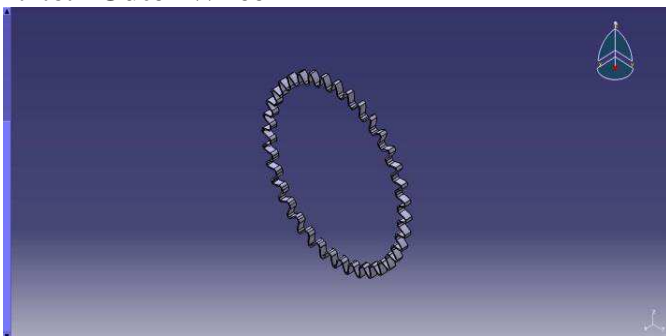


Figure 4.10 Outer Wheel in 3D Model

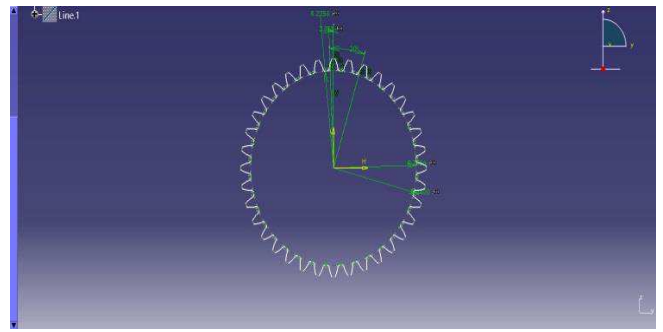


Figure 4.11 Outer Wheel in 2D Sketch

The above figures 4.10 and 4.11 are the 3D model and sketch of the Outer Wheel. The outer wheel is used to rotate in clockwise direction based on the ratchet and pawl wheel and outer support wheel assembly.

4.1.7. Stand

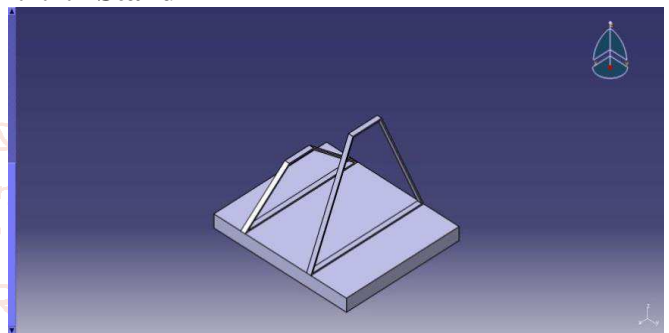


Figure 4.12 Stand in 3D Sketch

The above figure 4.12 shows the Stand in 3D sketch. The stand is used to support the whole assembly in the single position. This plays important role to make the whole system function properly.

4.1.8. Outer wheel to transmit the rotation

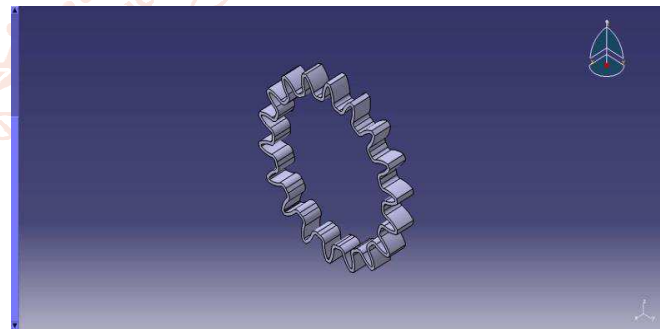


Figure 4.13 Outer Wheel to transmit the rotation 3D Model

The above figure 4.13 shows the Outer Wheel to transmit the rotation in 3D sketch. The Outer Wheel to transmit the rotation of main wheel to alternator using the shaft. Based on the clockwise rotation of the outer wheel, this wheel rotates in counter clockwise direction.

4.1.9. Shaft

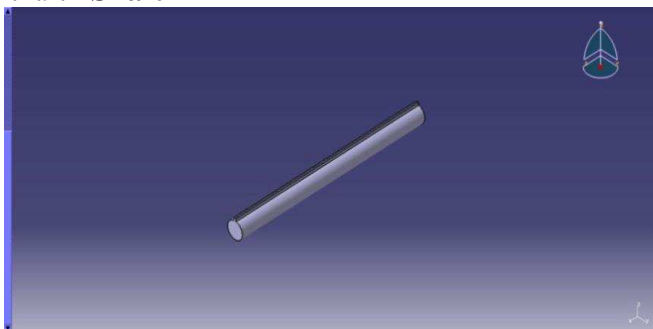


Figure 4.14 Shaft in 3D Model

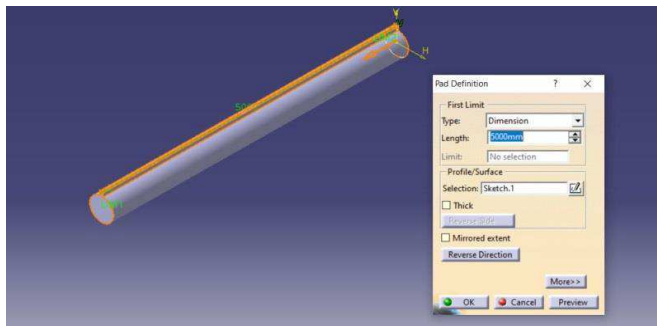


Figure 4.15 Shaft Length

The above figure 4.14 and 4.15 shows the Shaft in 3D sketch and shaft-extruded length.

The shaft is employed to transmit the outer wheel rotation because the mechanical input to the generator.

The shaft is connected with generator mistreatment coupling. The shaft rotates within the counter dextrorotary direction supported the direction Outer Wheel that is employed to transmit the rotation (fig.4.13).

4.1.10. Alternator

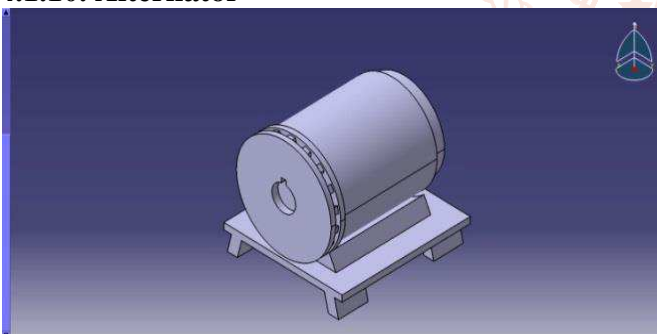


Figure 4.16 Alternator Setup in 3D Sketch

The above figure 4.16 shows the alternator setup in 3D sketch. The alternator is used to receive the rotational motion of the outer wheel (as mechanical input) and convert it into the electrical input.

4.1.11. Alternator Stand

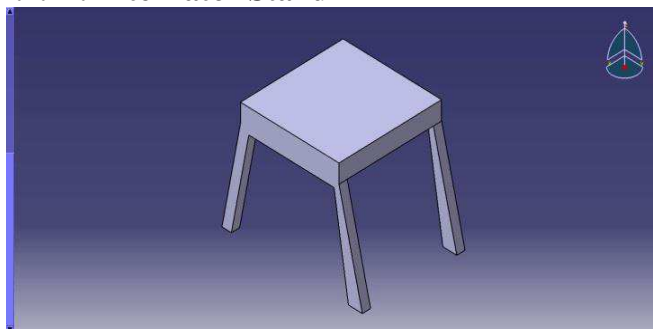


Figure 4.17 Alternator Stand in 3D Sketch

The above figure 4.17 shows the alternator stand in 3D sketch. The alternator stand is used to hold the alternator in same position when receiving the input.

4.2. Working Simulation of the Model

The process of working operation is explained using the figure (1) "Assembly of the Model". The working is "An operator sitting on the seat provided inside the wheel can use the J stick to go up inside the inner wheel, thus shifting the centre of gravity (CG) of the system to move forward. This movement of CG in the forward direction makes the toothed outer wheel to rotate. Since the outer wheel is connected to the gear wheels of GB start rotating when the person moves forward in his sitting position, the dynamo connected to the gear box shall produce electricity. Here the operator exerts minimum energy using the J stick to go up in the sitting position". The energy generated from the human work-out is mainly utilized for generating the basic electric appliances (like fan, tv, etc.) which is used by all people regularly. Energy generation varies based on the utilization of technology. The energy generating depends on the work out capability of human being and it is defined mainly in terms of human body mass index of human being. The work mainly concentrates on the main factor such as complete human body, energy generation for the basic and miscellaneous equipment for domestic purpose.

V. Conclusion And Future works

The rocking chair and ratchet-pawl mechanisms are used in work. The design of rocking chair housed inside the wheel is done using the CATIA V5 R20 software tool. This work is used for the energy generation for domestic purpose. This work helps to reduce the energy problem in future needs. The complete workout plays important role in this work in order to give a complete workout to human body parts with less effort. The domestic needs can be fulfilled based on the human workout condition. The energy generation can be used in emergency situation and in future purposes. The workout will help to give us a good feel and healthy life with useful energy generation purpose. The energy generation will ever

helpful in human daily needs. The energy generation is mainly produced using the human workout. Based on the workout the rotary motions are converted to energy using the alternator and belt drives and stored in battery for future needs. This work is mainly applied primarily to satisfy domestic needs.

5.1. Future Works

Applied for funding agencies like PRISM, ANGEL. Based on the funding amount the fabrication will be executed.

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References

- [1] Alejandro Rodríguez-Molina, Miguel G. Villarreal-Cervantes, Mario Aldape-Pérez (2020) "Indirect adaptive control using the novel online hypervolume-based differential evolution for the four-bar mechanism", *Mechatronics*, Vol. 69, pp.1-12.
- [2] Amir Hosein Sakhaei, Sawako Kaijima, Tat Lin Lee, Ying Yi Tan, Martin L. Dunn (2017) "Design and investigation of a multi-material compliant ratchet-like mechanism", *Journal of*

Mechanism and Machine Theory, Vol. 121, pp. 184–197.

- [3] M.S. Anoop, S. Dhanesh (2020) "Failure analysis and design optimization of alternator shaft used in rail coaches", *Journal of Materials Today: Proceedings*.
- [4] Ayneendra B, Vishwanath A V, Tejus Kumar R, Hemanth P (2017) "Fabrication of Swing Motion Power Generation", *International Journal of Latest Engineering Research and Applications (IJLERA)*, Vol. 02, pp. 18-26.
- [5] M.A. Bek, T.S. Amer, Magdy A. Sirwah, Jan Awrejcewicz, Asmaa A. Arab (2020) "The vibrational motion of a spring pendulum in a fluid flow", *Journals of Results in Physics*, Vol. 19, pp. 1-15.
- [6] Bianca Rodrigues de Oliveira, Maylla Luanna Barbosa Martins Bragança, Monica Araujo Batalha, Carla Cristine Nascimento da Silva Coelho, Heloisa Bettioli, Marco Antonio Barbieri, Maria da Conceição Pereira Saraiva, Gilberto Kac, Antonio Augusto Moura da Silva (2020) "Diagnostic performance of body mass index in detection of obesity using different cutoff points for excess body fat", *Journal of Nutrition*, Vol. 79-80, pp. 1-6.
- [7] K. Durkopp, H.-J. Bohnke and W. Jorden (1993) "Specific friction and wear mechanisms in clamping-roller free-wheel clutches", *Journal of Wear*, Vol. 162-164, pp- 985-989.
- [8] Gokul S P, Cyril John Tellis, Joash Anchan, Nikilesh Reddy Kalluri (2016) "Design and Fabrication of Human Powered Swing for Electricity Generation", *Journal of Recent Innovations in Science and Engineering- RISE 2016*.
- [9] Jiaying Zhang, Colin R. McInnes (2016) "Reconfiguration of a four-bar mechanism using phase space connections", *Journal of Mechanical Systems and Signal Processing*.
- [10] Jing Zhang, Hong-wei Guo, Juan Wu, Gui-jun Gao, Zi-ming Kou, Anders Eriksson (2018) "Design and analysis of flexure revolute joint based on four-bar mechanism", *Journal of Acta Astronautical*.
- [11] Juan Vicente Avelar, Juan Jose Galindo, Juan Pramy Ramos (2012) "Swing Human Powered Generator for the DC House Project", Department of Electrical Engineering Department, California Polytechnic State University, San Luis Obispo.

- [12] Juntakan Taweekun, Saba arif, Mas Fawzi, Nor Zelawati Binti Asmuin, Mohd Faizal Mohideen Batcha, Zamri Noranai (2018) "Design, fabrication and experimentation of swing electricity power generation system", International Journal of Engineering & Technology, Vol. 7, pp. 568-570.
- [13] Lakshya Shrivastava, Sumit Singh, Rahul Kushwah, Harsh Patidar (2018) "Research on Designing of Automatic Reverse Wheel Locking Mechanism", International Research Journal of Engineering and Technology (IRJET), Vol. 05, pp. 1712-1716
- [14] Liang Zhao, Ruoying Yu, Zhe Wang, Wei Yang, Linan Qu, Weidong Chen (2020) "Development modes analysis of renewable energy power generation in North Africa", Journal of Global Energy Interconnection, Vol. 3, pp. 237-246.
- [15] Priyesh Pradeep Revankar (2017) "Motion Analysis of Deltoid Mechanism", International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization), Vol. 6, pp. 1-6.
- [16] Rameshwar Kadu, Somesh Dhumane, Vikrant Gagare, Pravin Karpe, Prasad Shinde (2017) "Electricity Generation and Bottle Crushing by using swing", International Journal of Advance Research and Innovative Ideas in Education, Vol-3, pp. 2395- 4396.
- [17] Samson (1980) "The Time of Frictionless Motion of a Swinging Compound Pendulum", Journal of Medical Devices and Sporting Equipment, Vol: 102(4), pp. 818-822 (5 pages).
- [18] Sekiya Koike, Tatsuya Ishikawa, Alexander P. Willmott, Neil, E. Bezodis (2019) "Direct and indirect effects of joint torque inputs during an induced speed analysis of a swinging motion", Journal of Biomechanics, Vol. 86, pp. 8-16.
- [19] Siti Waridah Alimuddin, Rijal, Salki Sadmita (2020) "The relationship of body mass index and body fat composition with the foot arch among osteoarthritis patients", Journal of Enfermería Clínica, Vol. 30, pp. 168- 171.
- [20] Y. Tao, K. Inthavong, J.Y. Tu (2017) "Dynamic meshing modelling for particle resuspension caused by swinging manikin motion", Journal of Building and Environment, S0360-1323(17)30325-6.

