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Sovereign Fist Controlled Car Wheel Unscrewing Mechanism

Atif Saeed, Monahil Fatima
Department of Mechatronics Engineering,
SZABIST, Karachi
m.atif@szabist.edu.pk, monahilfatima@yahoo.com

Abstract

The undertaking plans to construct and make a four-wheeler spanner for fixing and removing four nuts in a single time. Nowadays everybody needs to spend time and effort through fostering some more cutting-edge strategy or part and complete them in day-to-day life. In this project we are targeting industry, innovation and infrastructure which is goal number 9 of SDG and the aim of the project is to develop a device that could not only reduce human effort but also reduces time. This device can also be easily utilized by females and older people. It's too difficult for female and older people to retighten the nuts because it takes too much force. This device helps them in changing the tire without consulting help from anyone.

Keywords: *Mechatronics, Sustainable development goals, Autonomous Car Jack*

1. Introduction

We are focusing on SDG # 9 To address future difficulties; our businesses and foundations must be updated. For this, we need to progress inventively and prudent developments. We are improving vehicle tire substitution apparatus. Why are we doing this? Since superseding the penetrated tire with the additional tire is by and large hard for women and the more established individuals in light of the fact that the force which is expected to remove the wheel nuts is very high. The nuts should be again fixed after productive replacement of the penetrated tire. On the contrary, the required force assumes not, at this point applied even as addressing the nuts, the nuts will lose and this may affect the main thrust's assurance. Usually, every vehicle is furnished with the tire substitution instruments, like L-molded nut remover and jack provided by the maker but these instruments are time consuming and also require more force. There is a need for a gadget used to lose the wheel nuts that should be

ergonomically organized, easy to deal with and ought to consume a little space for limits. It should similarly have the alternative to fix the wheel nuts [1]. The solution of this problem can be done with a multi nut working device whose principal objective is to lessen the work in fixing or slackening the nuts altogether. Using this device everyone will be able to remove and tighten the car wheel nuts easily. Multi nut remover can be made by numerous methods. It depends on every individual what they want to opt for.

IMPORTANCE OF SDG: Following are the facts to show why SDG # 9 is important. Below points shows the overall importance of Goal # 9:

1) 2.3 billion people need access to fundamental sanitation.
2) In some low-salary African nations, foundation requirements cut organizations' efficiency by around 40 percent.
3) People in developing countries don’t have access to constant electricity
4) The renewable energy sectors currently employ more than 2.3 million people, the number could reach 20 million by 2030.
5) In developing countries barely 30 percent of agricultural processes undergo industrial processing, compared to 98 percent high income countries.

A) Background Study

The basic aim of everyone is to make the work efficient in screwing or unscrewing nuts. They keep on adding more methods for this operation to make things easier for everyone especially for females and older people. [2] As indicated by them, the working of the vehicle's wheel nut remover and tightener simplify and can be performed by anybody. It doesn't need any aptitudes or anything, just key data about the game plan is needed for action. It works under the standard of clearing the wheel nuts at extremely low time through modified interaction with the help of an electric motor. It includes an electric motor, a post box connection, the electric motor is constrained by 12V DC yield. Toward the beginning the machine strategy is put with right fitting of the compartment association with the nut of the vehicle wheel. By then the ++motor regulator is turned on. The motor drives the posts which by then lead the case connection around the completion of the shaft. As the shaft rotates the connection moreover turns and the nut in the wheels are as such removed or fixed by the unrest of the connection. The fixing and removing system can be changed by changing the turn of the motor. Consequently, the wheel nuts can be fixed and ousted by this strategy. It is viewed as an essential strategy and particularly supportive for

every one for the tire removal and fixing measure. Hence with this direct technique, we are winning concerning making a beneficial method in the tire replacement methodology. By this course of action, the tire could be adequately ousted and fixed even more gainfully with less wastage of time and imperativeness used. They utilized the base plates of A 1018 Mild Steel Alloy; it is most customarily available when the crisp move gets ready. It is generally available in round bars, square bars, and square shape bars. It has a good blend of the whole of the normal characteristics of steel - quality, some adaptability, and relative straightforwardness of machining. Falsely, it is in a general sense equivalent to A36 Hot Rolled steel, anyway the infection moving method makes a predominant surface consummation and better properties. 1018 Mild (low-carbon) steel. These are the key portions which hold every one of the bits of the multi nut remover. Spike gears are set in these two plates. They hold driver pinion which is connected with the engine and subject for the pivot of the nut removers which are thus passed on into contact with the nuts to be cleared. It also dwells for the decided gear. The two plates act like a covering to the apparatus put inside. The two base plates are disengaged by some detachment. The DC engine determination of their undertaking is 40 RPM at 12 Volts. Their assessment paper for production of advantageous controlled nut remover and fixed is basically used unmistakably for one nut dispensing with and fix so it is eaten up as an ideal opportunity for each nut fixing and disposing of that why it isn't much useful. The power produced by the DC motor isn't suitable for disposing of and fixing. [3] They have focused on multi nut remover and the plan boundaries, force required and time spent on eliminating and fixing the nuts by various techniques or device like L-formed wrench, VAWNR and switch, Impact wrench, VAWNR and Impact wrench and recommended the VAWNR and Impact wrench by considering the time it cleared to eliminate and fix the nuts. The other part has zeroed in on the arrangement and showing up of 6 of each 1 all nut remover for vehicle wheels with 139.7mm PCD using CATIA V5R20 and explored the adequacy for passed on all wheel nut remover, testing was performed using the different open nut remover instruments, for instance, Lug wrench, Pneumatic weapon and all wheel nut remover device [2]. shown that most exceptional portrayal of strain for the screw to be loathsome requires a picked force, the driving force of the screw driver should in like manner be made high as exhibited by the decently lively of progress, at any rate a high force is needed for just a brief timeframe during the fixing of the screw, beside if some smother improvement is used to make this zenith degree. They focused on Multi nut opener can fixes for four-wheeler with the adaptable PCD and fostered a solitary device with different components, which can be made use during collecting and destroying of wheels in autos and utilized as a standard apparatus independent of the model of the vehicle, having a portion of the weaknesses

are it requires uniform level surface to put it on ground, it additionally requires focus arrangement with every one of the nuts, it consumes huge boot space, it likewise requires two absolutely releasing full batteries in the cordless effect wrench, plausible trouble while working with the nuts that are fixed with various force beforehand, to defeat to every one of these negative marks this undertaking has been done on the manufacture of versatile controlled nut remover and fixes. [4] They dealt with decreasing the heaviness of the instrument by having the lighter material on the base plate of the plan and creation of a multi-nut eliminating device. [5] The project aims to design and fabricate four-wheeler numerous initial spanners for fixing and expelling the four nuts in a solitary stroke of a hand worked switch. In their endeavor they have tried to concentrate on the minimization of human exertion and time depleted for fixing all of the four nuts of the ø100mm PCD tire with a solitary stroke of switch. This is finished by changing the five contraptions between two side plates worked indisputably by switch or information pinion shaft. First is "ON" the MOTOR to the regulator switch. Second it contains four spike gears, four shafts for prod gears, four box spanners and one switch on which the pinion gears are fixed. The chosen force of 47.49 N-m applied for ousting or fixing of catch is charming and replaces the nuts at basically faster rate when veered from the standard spanner. The human exertion needed for working the spanner is appropriately the same. Thus it is suggested that the distinctive worked spanner whenever made will show especially supportive for establishment of wheels while gathering the vehicles. They consider a four-wheeler taking out and overriding the vehicle instrument so one can loosen or tighten all of the four nuts at a time and at the single stroke of the hand worked switch. Basically, the standard number of clasps for a common vehicle is five "5" Yet, some more humble vehicles have just four "4" locks for each fight; a sharp vehicle has 3 fastens for each wheel. A vehicle by and large has the best fasten game-plan is the state of a star to tie down a wheel to the center point viably so their investigation paper project awful imprint is they not sort out the arrangement and computation of their assignment sensible for every vehicle which next to no valuable for every human moreover for value thought. While going through the distinctive exploration papers we discovered a portion of the comparable work we as a whole have done like Kress covered the fragments, for instance, different individual connection social occasions, standard weight instruments and planet gears, Housing, gas wrench. It affirmed that deliberately happening gear had driven the surface allowing it to be gone to clear clasp and gas structure for making positive concerning the latch. The gadget has the capacity for essentially conveying down the time needed for a tire trade. Additionally, as Hub of the Universe encased the added substances that hug every second arm, focal attachment, gears and a moving machine. It went to the information that the ring gear

takes strain to wait between the second arm and focal moving parts. This arrangement conjointly affirmed some viability in creation. Though they encased the parts consisting of nut accepting attachment, settling attachments. The gadget comprises by choice settled non-turning balancing out attachments settled to have collaboration entirely unexpectedly crazy while one is being released. Additionally, similarly as others inside the current materials, we moreover used SOLIDWORKs program for the design of multi nut working gadgets and the appraisal is finished. The arrangement relies totally upon the standard Pitch Circle Diameter that will be had in restriction of the auto tires. The store condition and surface homes are applied to the imported variation, concurring is done and is then enlightened to collect the effects. The results are concentrated to test the closeness of the design. Relative flexible pressing factor and Normal weight were gotten after the examination. Commonly everything around four nuts is dropping/fixed only by using the spanner/switch. It tends to be with the help of a section which we can use to fix the nuts one after another with a singular stroke physically or motor work switch. This is developed by adjusting the five mechanical assemblies among highlight plates worked best through switch or enter pinion shaft. The fundamentals of the rule of furnishing have been continued in organizing the spike gears. The fundamental guideline to make the light speed degree guessable, the teeth-closures of these cog wheels should be planned such that the typical ordinary line with firm factor/pitch point with center interests. Since the most depiction of insanity for the screw to be bad requires a chose force, the using nature of the screw primary impulse need to in like way be made extreme agreeing with the genuinely high speed of turn, though a ridiculous force is needed for handiest a short period of time during the fixing of the screw, beside some stagger improvement is utilized for the goal of making this height degree. The square of the degree of fixing of the screw is ordinarily influenced with the guide of wrench couplings or striking framework.

2. Methodology

- Pitch Circle Diameter for Gear = D = 76.3 mm
- Pitch Circle Diameter for Pinion = d = 38 mm
- Pressure Angle (Φ) =20˚
- Gear Ratio (G) = PCD of Gear/ PCD of pinion = 76.3 / 38 = 2.00
- By using Gear Ratio, Zg = G × Zp
- Number of teeth
  Zp = 17
  Zg = 34

- Zp= 17 and Zg = 34 are selected because both the values are present in Lewis form factor table.
- Module (m) = D/Zg = 76.3/34 = 2.25 mm.
- Face width (b) = 10 m then = 22.5mm

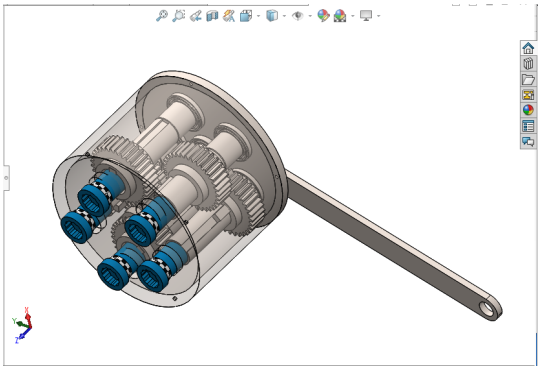

Fig 1: CAD Model A

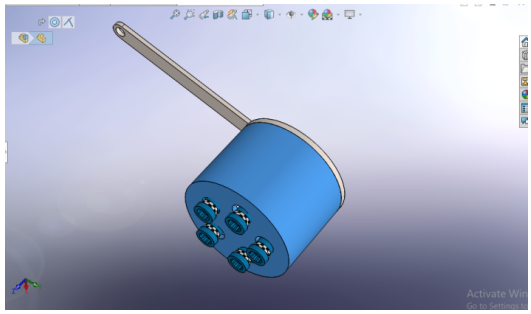

Fig 2: CAD Model B

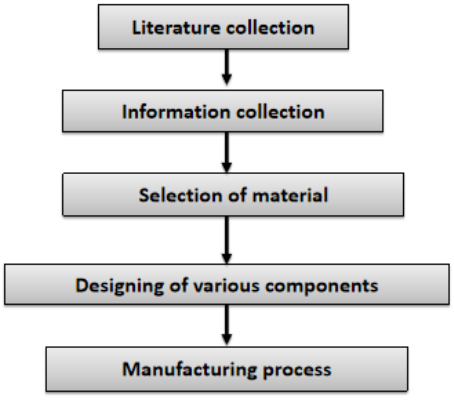

Fig 3: Design Process

The above flowchart shows the start to end procedure of the project. First, we find all the information available on the internet and then compile it in some files. Then we select the material which is available in the market and test how it will behave on certain loads. After that we design all the parts of the multi nut remover and tightener with dimensions and at last we complete the manufacturing process and finish our product.

A) Simulations

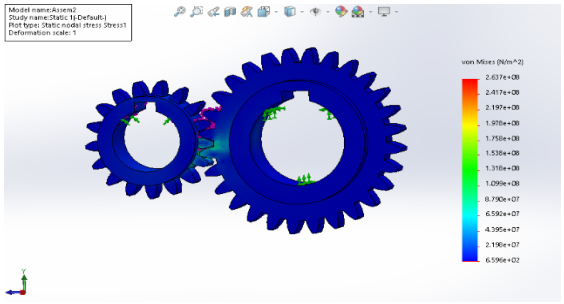

Fig 4: Stress Analysis of Meshing Gear at 90Nm.

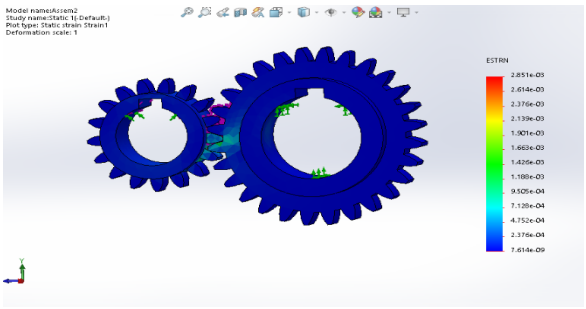

Figure 5: Strain Analysis of Meshing gears at 90Nm

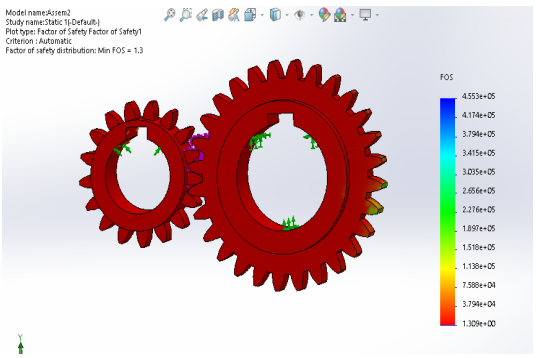

Fig 6: Factor of Safety of Meshing Gear

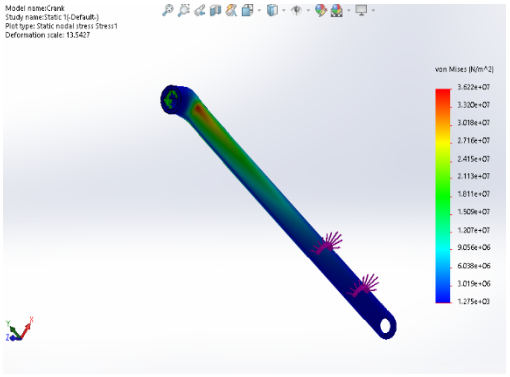

Fig 7: Stress Analysis of moving Crane at 90Nm

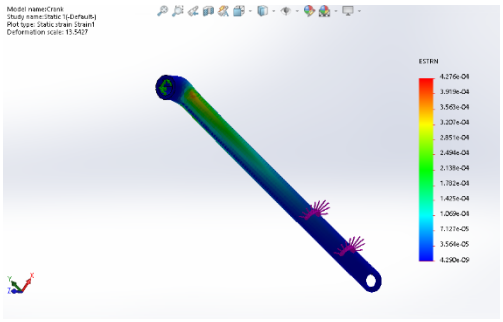

Fig 8: Strain Analysis of moving crank at 90Nm

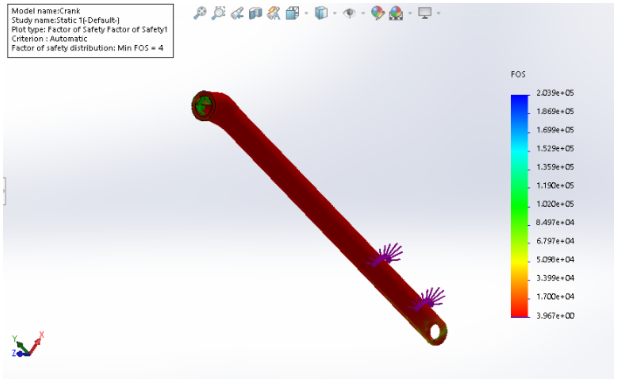

Fig 9: Factor of Safety of Crank

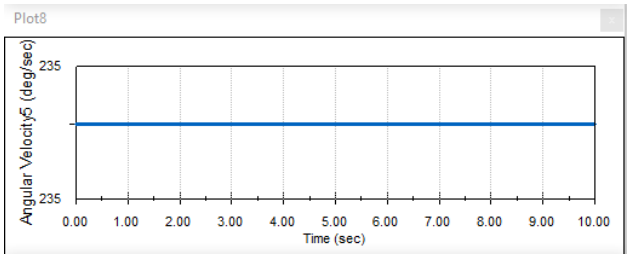

Fig 10: Motion Analysis of Crank

3. Conclusion

So basically, the aim of this paper is to develop a device that could be beneficial in opening and tightening of car wheel nut at a single time, so it would not only reduce time but also with the help of less force and easily used system, many female and older person can also utilize this device in the time of need. The other aim of the project is to do some innovation in the industry and to achieve SDG. The future scope from this project are follows:

- Try something new like gear arrangements of different dimensions so that the power consumption to tight or loose nuts will be less.
- This project only applicable for cars who have 100 PCD so try something new in the gear arrangement so that it can be adjusted to any nut size

4. References

[1] A. Saeed, M. Siddiq, S. H. Mustafa, U. Jawed, and L. Shahid, "Validation of Hertz Theory in order to increase the efficiency of gear element (Plastic and Fiber)," 2019 Int. Conf. Inf. Sci. Commun. Technol., pp. 1–5, Mar. 2019, doi: 10.1109/CISCT.2019.8777415.

[2] M. Thirunavukkarasu and V. Lakshminarayanan, "Incorporation of a secondary wheel assembly using novel zigbee based traction control system for vehicle stability during tire blow-outs," Int. J. Veh. Struct. Syst., 2018, doi: 10.4273/ijvss.10.6.06.

[3] V. Lonkar, S. Patil, A. Mahadik, C. Pawar, and A. Joshi, "Motorized Operated Multi Spindle Spanner," Int. Adv. Res. J. Sci. Eng. Technol., 2016.

[4] A. Bhanage, S. Bedse, K. Devare, V. Batte, and K. Dixit, "Design and development of all wheel nut remover for automotive," Int. J. Appl. Eng. Res., 2015.

[5] M. A. H. Ali and M. A. Alshameri, "An intelligent adjustable spanner for automated engagement with multi-diameter bolts/nuts during tightening/loosening process using vision system and fuzzy logic," Int. J. Adv. Manuf. Technol., 2019, doi: 10.1007/s00170-018-3133-0.