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"Development and Fabrication of Fifth Wheel for Vehicle Parking System"

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Chapter 1

Introduction

Parallel parking is a method of parking a vehicle in-line with other parked vehicles. Parallel parking requires initially driving slightly past the parking space, parallel to the parked vehicle in front of that space, keeping a safe distance, and then followed by reversing into that space. Subsequent position adjustment may require the use of forward and reverse gears. Parallel parking is considered to be one of the hardest skills for new drivers to learn. Parallel parking enables the driver to park a vehicle in a smaller space than would be true of forward parking. Driving forward into a parking space on the side of a road is typically not possible unless two successive parking spaces are empty. Reversing into the spot via the parallel parking technique allows one to take advantage of a single empty space not much longer than the car in order to complete the parking within three wheel-turns the parking space would generally need to be about one and a half car length long.

The work on parallel parking of car using fifth wheel according to, Parallel parking is the method of park the vehicle parallel in between the two vehicle keeping the safe distance. They developed a system by introducing a fifth wheel at the rear side of the vehicle. The pneumatic system is used as a jack to lower the wheel and lift the vehicle from the rear side. The prime mover is used to provide a power to the fifth wheel and for forward and reversed rotation is also done by motor. Firstly, the driver places the vehicle at an angle from the front. As soon as the driver pushes the button the wheel is goes downwards and vehicle lifted up from rear side. The prime mover gives the rotation to the wheel as per the requirement (Forward or Reversed) and the vehicle park in between the vehicles. For this system they implement a digital display to indicate the status of the fifth wheel done the work on fabrication of parallel car parking, using 5th wheel according to his study, In earlier methods of parking, the time taken is 2 minutes (approx), the driver needs to be more alert while parking in order to avoid hitting of the car during the reverse motion. Therefore, to avoid these inconveniences, a concept of parallel parking is made, where the total time will be 50 to 60 seconds. This parking can be done using an additional wheel, a pneumatic cylinder and solenoid valve set up is used to control fifth wheel to land and lift. A DC motor enables the forward and reverse motion for the fifth wheel. A digital display is used to indicate the status of the wheel for the driver reference. It also helps to know malfunctions during landing or lifting of the wheel. This concept is mainly used for four-wheeler vehicles. This setup makes the vehicle to turn parallel in a significant angle with reference to the front axle within a short period. The model enables the driver to park the vehicle between two vehicles, where the space is limited. This is carried out by us made an impressing task in four wheelers. It is very useful for

parking four wheelers, because they need not take any risk for park the vehicle and quick operation. This project will reduce the cost involved in the concern. Project has been designed to perform the entire requirement task at the shortest time available fifth wheel according, parallel parking is a method of parking a vehicle in-line with other parked vehicles. Parallel parking requires initially driving slightly past the parking space, parallel to the parked vehicle in front of that space, (hence the term 'Parallel Parking'), keeping a safe distance, and then followed by reversing into that space. Subsequent position adjustment may require the use of forward and reverse gears. Parallel parking is considered to be one of the hardest skills for new drivers to learn. Parallel parking enables the driver to park a vehicle in a smaller space than would be true of forward parking. Driving forward into a parking space on the side of a road is typically not possible unless two successive parking spaces are empty. Reversing into the spot via the parallel parking technique allows one to take advantage of a single empty space not much longer than the car (in order to complete the parking within three wheel turns the parking space would generally need to be about one and a half car-length long). The is carried out by us made an impressing task in four wheelers. It is very useful for parking four wheelers, because they need not take any risk for park the vehicle and quick operation. This project will reduce the requirement of time & effort task during parking of vehicle.

The work on, Design and Fabrication of an Automated Multilevel Car Parking System, according to his study, in this paper, the basic multi-level car parking system with three floors is considered to show the use of control systems in parking systems. The control system will play a major role in organizing the entry to and exit from the parking lots. It also presents the design of multi-level parking lots which occupies less need on the ground and contains the large number of cars. In the modern world, where parking-space has become a very big problem, it has become very important to avoid the wastage of space in modern big Automatic multi-level car parking system helps to minimize the car parking area companies and apartments. The parking lots have an elevator to carry cars to different floors according to the vacancies. The elevator is controlled by a programmable logic controller (PLC) along with the help of some sensors. The multi-level car parking system had successfully been designed and developed. The control strategy for the traffic flow to the multi-level car parking system was carried out using the PLC. The PLC with the help of some sensors checks the availability of the vacant place on each floor. It can be noticed that the control system for the multi-level car parking system has achieved the anticipated performance to regulate the entry and exit of the car to/from several floors accurately. The movement of the elevator between the floors was continuous and smooth as requested. The number of entering and existing car from all the three floors was controlled as per the signals from the sensors on each floor at the entry and exit point. The entry and exist phases of the cars depends on the availability of the elevator and the time required for exist. The preference for the entry will be for the car that is present at the stopping in front of an elevator at the ground floor. Meanwhile, the preference for exist from other floors will depend firstly on the space and secondly on the time demanded for exist. Introduction to vertical multistage car parking system according to his study, In metropolitan cities, vehicle parking has become a major concern in all busy areas and a good traffic system needs a good parking system. Different types of vehicle parking are applied worldwide namely Multi-level Automated Car Parking, Automated Car Parking System, Volkswagen Car Parking, vertical car parking etc. Parallel parking is challenge for all drivers say amateurs or the experts. A multistage car parking system is a solution to this ordeal. This paper explains in detail a simple and precise multistage car-parking introduction, advantages, characteristics, etc. This paper give the information to develop a reduced working model of a car parking system for parking 6 to 24 cars within a parking area of 32.17 m^2. The chain and sprocket mechanism is used for driving the parking platform and a one fourth hp brake motor shall be implemented for powering the system and indexing the platform .The platform is fabricated to suit. Vertical Car Parking model has been designed; all the parts in it were manufactured and assembled and tested successfully. Analysis of the model has been done and developed with the scaling of 1:9 for life size model Such as SUV's like fortuner. As the life cycle model involves proper design and advanced methods are to be used to meet the requirements of the customer. Quick Automated Parking and retrieval of vehicles. Up to 12 cars can be easily and safely parked. Surface space required equivalent to just 2 surface car parking spaces. Most

suitable for Staff or dedicated user parking. Engineered to ensure Driver safety by use of an electronic Safety zone. Low maintenance levels required by the system.

Roads that facilitate parallel parking have an additional lane or an outsized shoulder for put cars. It's also used whenever parking facilities aren't accessible typically in giant metropolitan areas wherever there's a high density of vehicles and few (or restricted) accommodations like multi- keep automobile parks. Some jurisdictions have eliminated individual spots permitting shorter vehicles to use less area. Parallel parking could be a methodology of parking a vehicle in-line with different put vehicles. Parallel parking needs at first driving slightly past the auto mobile parking space, parallel to the put vehicle before of that area, keeping a secure distance, and so followed by reversing into that area. Later position adjustment could need the utilization of forward and reverse gears. Parallel parking is taken into account to be one in every of the toughest skills for brand new drivers to be told. Driving forward into a parking space on the side of a road is typically not possible unless two successive parking spaces are empty. Parking system: A car parking system is a device that multiplies parking capacity inside a parking lot. Parking systems are generally powered by electric motor or hydraulic pumps that move vehicles into a storage position

So, let's step back in time to consider a nifty innovation that made it much easier to squeeze into a tight spot. Back in the 1950s, a man named Brooks Walker invented "fifth wheel driving," wrote Old Cars Weekly. The system utilized a hydraulic pump and the car's spare tire to guide the vehicle in and out of parking spaces. It could also turn the car in a complete circle. Walker created a prototype on his own Packard Cavalier. (He was from the San Francisco Bay Area, where the steep streets can make parallel parking especially tricky.) Walker demonstrated "fifth-wheel driving" at numerous auto shows. "With new cars getting bigger and parking spaces getting smaller an inventor has developed something to soothe the motorist's headache," a newsreel narrator enthused. But the big car companies didn't jump on the bandwagon. The inventor apparently spent the next 20 years tinkering with the idea, with the ultimate goal of making the system "a bolt-on kit that could be applied to any car without changes to its basic structure," Old Car Weekly wrote. Watch the video below to see how Fifth-Wheel Driving worked. Before long he was making the rounds again, this time demonstrating his park assist device on a 1953 Packard Cavalier and taking advantage of an extended continental kit to mount the fifth wheel outside the trunk. Using a series of gears and hydraulic pumps and lines, Walker's system could be activated with the push of a button beneath the dash. Surprisingly, Detroit said no again. Walker continued to perfect his parallel parking system into the 1970s, but he died without ever realizing his dream—a dream that is now reality. So, the next time you take your hands off the wheel of your Chevy Malibu as it methodically parallel parks itself, give thanks for Brooks Walker

1.1 Problem statement :

In automobiles, parking system is complicated and time taking to park the vehicle, needs to be more alert while parking in order to avoid hitting of the car during the reverse motion. Therefore, to avoid, a concept of fifth wheel parking is made.

1 .2 Objectives:

- To understand the basic principal of the our project
- Describe the construction and working of various parts of our project
- Development of the working model of the our project
- To reduce time spent on this activity.
- To analyze the technology according to needs and capabilities

1 .3 Scopes:

To make a working model of Fifth wheel drive, for an ease of parallel parking in cities and uneven road conditions. A vehicle featuring low cost and user-friendly steering mechanism for Auxiliary wheel has been introduced. This paper focused on a steering mechanism which offers feasible solutions to a number of current maneuvering limitations. A prototype for the proposed approach was developed by introducing separate mechanism for normal steering purpose and 360-degree steering purpose. This prototype was found to be able to be maneuvered very easily in tight spaces, also making 360◦ steering possible.

1.4 Methodology:

In this project work it is proposed to carry out on fabrication of fifth wheel for vehicle parking system.

Phase I-Literature survey.

In this phase literature survey fabrication of fifth wheel for vehicle parking system International Journal of Science and Engineering, International Research Journal of Engineering and Technology, International Journal of Innovative Research in Technology, International Journal of Engineering Research & Technology, International Journal of Pure and Applied Mathematics, Earth and Environmental Science, International Journal of Engineering Research & Technology, Journal of Engineering and Applied Sciences, International Conference on Information Systems etc.

Phase II –Analysis.

In this phase preparation of model of existing fabrication of fifth wheel for vehicle parking system and its analysis using analytical procedure will be done. Then according to the results of existing model of fabrication of fifth wheel for vehicle parking system will be done to predict the results.

Phase III –Fabrication and testing.

- New modified Fifth wheel for vehicle parking system will be manufactured.
- The testing of will be carried on the existing model

Phase IV –Compilation of Result, Discussion and Conclusion.

- In this phase the result obtained by existing model and discussed. In short this phase gives brief results of project. Conclusion will be drawn on the basis of analytical and experimental results.

1.5 Organization of Dissertation:

The report is organized as per the sequence of work done.

Chapter 1: Describes the Introduction, Problem statement, Objective, Methodology.

Chapter 2: Describes the brief literature review on the work done by different researchers

Chapter3: Components and there Specifications.

Chapter4: Describes the Working of Components

Chapter 2

Literature Review

Meghraj Gadhavel and et al., (2021) presented the time taken is 2 minutes; the driver needs to be more alert while parking in order to avoid hitting of the car during the reverse motion. Therefore, to avoid these inconveniences, a concept of fifth wheel parking is made, where the total time will be 50 to 60 seconds. This parking can be done using an additional wheel fifth wheel. A screw is used to control fifth wheel to land and lift. DC motor enables the forward and reverse motion for the screw. It also helps to know malfunctions during landing or lifting of the wheel. This concept is mainly used for four-wheeler vehicles. This setup makes the vehicle to turn parallel in a significant angle with reference to the front axle within a short period. The model enables the driver to park the vehicle between two vehicles, where the space is limited.

Shrikant Jogi, and et al., (2019) presented the parking can be done using an additional wheel fifth wheel. A screw is used to control fifth wheel to land and lift. DC motor enables the forward and reverse motion for the screw. It also helps to know malfunctions during landing or lifting of the wheel. This concept is mainly used for four-wheeler vehicles. This setup makes the vehicle to turn parallel in a significant angle

with reference to the front axle within a short period. The model enables the driver to park the vehicle between two vehicles, where the space is limited.

Dr. A. P. Sivasubramaniam and Dr. M. Makesh, (2022) presented the Parallel parking is a method of parking a vehicle in-line with other parked vehicles. Parallel parking requires initially driving slightly past the parking space, parallel to the parked vehicle in front of that space, (hence the term 'Parallel Parking'), keeping a safe distance, and then followed by reversing into that space. Subsequent position adjustment may require the use of forward and reverse gears. Parallel parking is considered to be one of the hardest skills for new drivers to learn. Parallel parking enables the driver to park a vehicle in a smaller space than would be true of forward parking. Driving forward into a parking space on the side of a road is typically not possible unless two successive parking spaces are empty. Reversing into the spot via the parallel parking technique allows one to take advantage of a single empty space not much longer than the car (in order to complete the parking within three wheel-turns the parking space would generally need to be about one and a half car length long).

Vaibhav Channewadkar and et al., (2021) presented the methods of parking, the driver would take to be more time as well as alert while parking in compact spaces avoid hitting of the vehicle during the movement of vehicle. The parking is a big problem in the big cities due to congestion of roads and traffic regulation and if it is an unskilled driver it will be a big problem to the other drivers also maximum time is needed for parking. Therefore to avoid these inconveniences, a concept of parking is developed for taking least time for parking and aim of this system is to fold the auxiliary wheel for better space adaptability also placed in boot space. This parking can be done using an additional wheel (an Auxiliary Drive Wheel) most probably this will be a Stepney wheel. Initially, when the driver finds a slot for parking, he pushes the button and the DC motor actuate the movement of rack and pinion. Rack and pinion will applied force on the one side of triangular hub and due to the pivot point the triangular hub move in angular moment and other side of triangle will lift auxiliary wheel. This will land the auxiliary wheel on the road and slightly lifts the rear side of the vehicle. A rack and pinion and triangular hub set up is used to control an Auxiliary drive wheel to land and lift. The model enables the driver to park the vehicle between two vehicles, where the space is limited.

Mr. Paresh G. Chaudhary, and et al., (2018) presented the One of the main problems of the collaborative mobile robot application is to share the exact information of the robot itself and the surrounding area. Each robot needs to maintain its stability and positioning in order to achieve the target. As one of the samples of achieving the positioning task, a parallel parking problem was used in this paper. This paper used a car-like robot to do a parallel parking task. Front wheels were steered by using a connected joint and a servo motor. Meanwhile, each of the rear wheels was connected to a motor DC. Four ultrasonic sensors were used to find the distance between the robot and its surrounding (fixed in front, back, middle right, and middle of right - back side). The sensors connected to an Arduino Uno as the main microcontroller. The robot used a positioning algorithm based on the distance to nearest objects. The robot is designed only for parking on the right side of the car with an assumption there is no obstacle in the left side of the car. The experimental results confirmed that our system can solve the parallel parking problem. However, during the test, the output of the sensor was were affected by the noise from the environment. Another problem was the robot hardly to move straight because the rubber tires were not installed neatly. In the future works, the data output needs to filter and corrected and the servo degree needs to be initially corrected based on thechassis and tires angle.

Ashwini H Y, and et al., (2021) presented theA sensible Parallel parking system is that the Method to park vehicle parallel to other parked vehicles. The ParallelParking system consists of both software and specialized hardware, which helps to create the motive force task easy and also, it helps to attenuate the damage to other parked car. This technique is principally supported Nuvoton microcontroller, mechatronics concepts and with the assistance of DC motor, chain system and also the wheels of the vehicle rotating in 90 degree. The DC motor helps to rotate the wheels of the vehicle. This technique is additionally implemented by Bluetooth technology and ultrasonic sensor. Bluetooth Technology for giving instructions to the vehicle like forward, backward, left, right. Ultrasonic Sensor are used which can sense the objects between to avoid

accident. If the item is simply too near the vehicle, then the alarm will gets activated. This technique result helps in making the motive force task easy and easier, less time requirement, more accuracy and reduction in accidents.

Muhammad Faiz Bin Wahab and et al., (2015) presented theCollisions can happen during reversing or parking the car especially in the limited space. Since many drivers acknowledge that parallel parking is a very tedious task. This research aims to develop the parallel parking system by developing small mobile vehicle as a model. Design of prototype vehicle is considered for the real-life parallel parking. Hence, it can detect a parking space, execute the parking maneuver, avoid hitting the front, rear obstacles and reduce the time for parking. The parking maneuver is simplified by choosing the optimum turning angle for both the first and second parts of the parking maneuvers. At the first stage, ultrasonic sensors sense the parking environment and if the space is sufficient, a safe parking maneuver is generated. In second stage, positioning phase, the mobile vehicle will execute reverse motion into the parking space without any collisions. The last stage, it moves to the correct parking position in the parking space while adjusting itself to a safe distance from front and rear obstacles respectively. It is discovered from the result that developed system required just 1.33 times longer parking space than vehicle overall length. Small mobile vehicles successfully able to manage the parallel park itself without hitting or touching front and rear obstacles.

Muftah Fraiferand Mikael Fernström (2016) presented the literature review conducted for this paper offers an in-depth review of the recent advances in sensing and communication technology concerning parking systems. In addition, this paper presents a survey and analysis of an academic, qualitative literature review. It includes an in-depth study of the selected topics and provides a step by step implementation process. It reviews different smart parking systems used for parking guidance and parking facility management and gives an insight into the technical aspects and specifications analysis of such systems that have been published in academia during the last 15 years.

In 1950s, The Walker had developed a parallel wheel parking system for automobiles and trucks and he developed in his conception in an exceedingly Saab sedan car conjointly developed his self -parking conception in ford beach waggon. conjointly in 1970s of these ideas of automobiles modifying by that tire may be fitted underneath chassis and hidden underneath the car, motivated once the method begin for parking in slots. every of this method got to set at very cheap of every automobile. This mechanism was fitted underneath the chassis that with facilitate of rack and pinion or with the assistance of centrally fitted worm and gear wheel. The Packard Cavalier developed the conception that is totally different from Walkers parking conception. The Packard used the additional tire for the parking and this originated was used move the automobile in circular arrangement. This idea applied to the automobile with none changes within the entities or in structure of automobile.

Jhanvi Nimble et.al. had developed bound ideas for parking in huge cities or busy cities, notably facing the traffic problems, was tough within the car park. Parking drawback had huge issue to face traffic network and in life quality. completely different ideas were developed for progress in automatic or simple parking for vehicles. final aim of her analysis was to develop glorious, user friendly automatic automotive parking that reduces personnel, traffic congestions and secure parking slots in restricted space. the standard parking systems were like structure, automaton automotive parking systems, automatic structure automotive parking systems etc. had been used on an oversized scale. however these systems have a serious disadvantage of enormous area consumption that is with success eliminated with the assistance of parallel automotive parking mechanism. varied ways were used for development of autonomous and intelligent parking systems. Study of those systems needs a trifle or a lot of human interference for the functioning. sensible Parking system planned a mechanical model which incorporates image process facility. With the assistance of carry cars were put at multiple levels. To captured the amount plate and hold on in info for comparison to avoid unofficial automotive entry image process was used. the most benefits of this systems were area optimization, value effectiveness and security.

D. Gorinevsky et.al. had performed the implementation of a parking control system to support an automatic parking system mode in activate in cars. By using development in the parking concept technique without using the manpower for controlling the parking of cars. They invented controller for controlling of

parking. They came to conclusion of the calculation and designing, containing parking problem analysis, problem. Two general cases of backward parking considered in this work are emulated using the proposed controller. The controller design gave high efficiency and proves that the prototype system can be invented for a typical passenger car. They had proven that automatic parking well as simply solving the parking problem with the help of controller, but with huge complex cases of car parking as well. The car parking problem results proved that and gets exact confirmation of solution to the automatic parking control problem. Automatic parking can be invented for the solving parking problem.

Sawankumar G. Narone et.al. had focused on car manufacturing related with the ease of Car Parking System. This system had developed to reduce the use of large land space for the parking which was creating problem in big busy cities. Various types of parking systems are gathering all over the world namely automatic car parking, rotary car parking, autonomous car parking, parallel parking, fifth wheel parking. The present problem of parking is target to invent automatic prototype model which can solve the original issue face by big cars for parking in parking area. The chain, sprocket, rack and pinion, worm and worm gear mechanism is get link and form mechanism. This whole prototype model is work and rotates by a D.C motor or stepper motor. When the car street or road or parking slots the car is ready for the parking and the vehicle become park. When the button will pressed by the operator, sprocket starts the rotating and the vehicle become park taken less space as well, so they were using this concept to build the technology of automatic parking to where it is needed.

Amin Kianpisheh et.al. had explained about increased used of cars with increasing population and its adverse effects on surroundings of vehicle mass production, but large space for the parking places and lands are required. Hence they had developed the concept for vehicle parking system defines as the smart parking system(SPS) is invented for taken as less time and less space as well. The new concept had been developed by using the ultrasonic sensors to identifying the either space for car parking or to less space for park. Various concepts have been developed but as compared to other techniques smart parking is the best technology. The smart parking was containing the various process space detection, parking space, image processing, viewing of less space for parking, indicating the correct direction, and payment facilities and different types of parking spaces through the use of specific controlling unit. They had been described automatic parking system from car enter in parallel parking slots the controller detecting the vacant spaces on road side or street. The system containing the image processing to display the car motion to park in slots with help of sensors or LED.

Mayur S. Raipure et.al. had described about development in the parking system through the automobile industry ,particularly in the four wheelers. Also they were explained the main purpose to wheel move in circular motion (90 degree). Four wheeler or any vehicle can be park in any direction with getting from planned and regulated movement as compared to the other larger vehicles. The ability to move along any direction irrespective of the orientation of the vehicle makes it an attractive option in dynamic environment. They used some system for certain movements in which can be seen in car. Here they had described on the prototype model which can easily movement in all directions on the street. They had discussed about motion and movement about the car system which implement in actual vehicle. They said that the advancement in the parking problem is very important .The improvement in the automobile industry especially in the four wheeler is tough challenge for us.

Apurva Medhekar et.al. had recent search on major problem facing against the car parking in congested or small spaces. Large scale infrastructure companies like Whor, Tal manufacturing ltd, Claus, Pari parking solutions, Dae Duck engineering, etc. developing concept for the parking implemented in the car. The car can be rotated in 3600 with safety of car. This system was much efficient for parking in circular or lateral direction in the less space utilization or other energy available sources. This system concept has contained the conveyor belt, controller system, solar panels. With all the combination of parking types are the unique one from all other parking system which invented for the ease of parking, less spacing required, with minimum cost and manipulate. As compared to other parking system multilevel circular parking system becoming efficient than other for less consuming space as well as safety.

After doing the above literature survey it is decided that project work is to develop the fabrication of fifth wheel for vehicle parking system

Chapter 3

Design and design consideration of the project

3.1. Design consideration of the project

3.1.1 Introduction:

Project design may be defined as the iterative decision making activity to create a plan or plans by which the available resources are converted, preferably optimally, into systems, processes or devices to perform the desired functions and to meet human needs. In fact project design has been defined in many ways but the simplest ways to define project design as

"An iterative decision making process to conceive and implement optimum systems to solve society's problems and needs."

Project design is practical in nature and must be concerned with physical reliability, or economic and financial feasibility Design is essentially a decision-making process. If we have a problem, we need to design a solution. In other words, to design is to formulate a plan to satisfy a particular need and to create something with a physical reality.

3.1.2 Basic concept of project design:

Decision making comes in every stage of design. Consider two cars of different makes. They may both be reasonable cars and serve the same purpose but the designs are different. The designers consider different factors and come to certain conclusions leading to an optimum design. Market survey gives an indication of what people want. Existing norms play an important role. Once a critical decision is made, the rest of the design features follow. For example, once we decide the engine capacity, the shape and size, then the subsequent course of the design would follow. A bad decision leads to a bad design and a bad product.

Design may be for different products and with the present specialization and knowledge bank, we have a long list of design disciplines e.g. ship design, building design, process design, bridge design, clothing or fashion design and so

3.1.3 Types of project design:

There may be several types of design such as

1. Adaptive design

This is based on existing design, for example, standard products or systems adopted for a new application. Conveyor belts, control system of projects and mechanisms or haulage systems are some of the examples where existing design systems are adapted for a particular use.

2. Developmental designs

Here we start with an existing design but finally a modified design is obtained. A new model of a car is a typical example of a developmental design.

3. New design

This type of design is an entirely new one but based on existing scientific principles. No scientific invention is involved but requires creative thinking to solve a problem. Examples of this type of design may include designing a small vehicle for transportation of men and material on board a ship or in a desert. Some research activity may be necessary.

- **Types of design based on methods**

4. Rational design:

This is based on determining the stresses and strains of components and thereby deciding their dimensions.

5. Empirical design:

This is based on empirical formulae which in turn are based on experience and experiments. For example, when we tighten a nut on a bolt the force exerted or the stresses induced cannot be determined exactly but experience shows that the tightening force may be given by P=284d where, d is the bolt diameter in mm and P is the applied force in kg. There is no mathematical backing of this equation but it is based on

observations and experience.

6. Industrial design:

These are based on industrial considerations and norms viz. market survey, external look, production facilities, low cost, use of existing standard products.

3.1.4 Factors to be considered in project design

There are many factors to be considered while attacking a design problem. In many cases these are a common sense approach to solving a problem. Some of these factors are as follows:

(a) What device or mechanism to be used? This would decide the relative arrangement of the constituent elements.
(b) Material
(c) Forces on the elements
(d) Size, shape and space requirements. The final weight of the product is also a major concern.
(e) The method of manufacturing the components and their assembly.
(f) How will it operate?
(g) Reliability and safety aspects
(h) Inspectibility
(i) Maintenance, cost and aesthetics of the designed product.

- **What device or mechanism to be used:**

This is best judged by understanding the problem thoroughly. Sometimes a particular function can be achieved by a number of means or by using different mechanisms and the designer has to decide which one is most effective under the circumstances. A rough design or layout diagram may be made to crystallize the thoughts regarding the relative arrangement of the elements.

1. **Material:**

This is a very important aspect of any design. A wrong choice of material may lead to failure, over or undersized product or expensive items. The choice of materials is thus dependent on suitable properties of the material for each component, their suitability of fabrication or manufacture and the cost.

2. **Load:**

The external loads cause internal stresses in the elements and these stresses must be determined accurately since these will be used in determining the component size. Loading may be due to:

i) Energy transmission by a project member.
ii) Dead weight.
iii) Inertial forces.
iv) Thermal effects.
v) Frictional forces.

3.1.5. Steps in project design

Project Design or mechanical design is primarily concerned with the systems by which the energy is converted into useful mechanical forms and of mechanisms required to convert the output of the project to the desired form. The design may lead to an entirely new project or an improvement on an existing one. Thus project design is the production or creation of the right combination of correctly proportioned moving and stationary components so constructed and joined as to enable the liberation, transformation, and utilization of energy.

The basic procedure of project design (Mechanical Project Design) consists of a step by step approach from given specifications of functional requirement of a product to the complete description in the form of blue prints of the final product. The following steps are involved:

First Step:

In the very first step a complete list of specifications for the functional requirement of the product is to be prepared. The requirement may include, for example:

(a) Output capacity;

(b) Service life;
(c) Cost;
(d) Reliability; etc.

In consumer products, in addition appearance, noiseless operation, and simplicity in control are important requirements. Depending upon the type of product, various requirements are given Weight age and a priority list of specifications is prepared.

Second Step:

After a careful study of the requirements the designer prepares rough sketches of different possible mechanisms of project and depending upon the cost competitiveness, availability of raw material, and manufacturing facilities, the possible mechanisms are compared with each other and the designer selects the best possible mechanism for the product

Third Step:

In the third step of the design procedure a block diagram is to be prepared which showing the general layout of the selected configuration. In this step designer specifies the joining methods, such as riveting, bolting, and welding to connect the individual components. Rough sketches of shapes of individual parts are prepared.

Fourth Step:

- After selecting the required or deciding the configuration of mechanism /project in third step above. The design of individual components of the selected configuration is to be done in this step. It consists of the following stages:
- Determine the forces acting on each component;
- Selecting the proper material for the component depending upon the functional requirement, such as strength, wear, rigidity, hardness and bearing properties etc.
- Determine the likely mode of failure & select the criterion of failure like, yield strength, ultimate strength, deflection etc.
- Determine the geometric dimensions of the components using suitable factor of safety and modify the dimensions from manufacturing considerations. This stage involves the detailed stress analysis.

Fifth Step:

The last stage in design process is to prepare the blue prints of assembly and individual component. On these drawings, the material of the components, dimensions and tolerances, surface finish and machining methods are specified.

The designer prepare two separate lists of components

- Standard components to be purchased directly from the market;
- Special components to be projects in the factory;

Thus the project design or mechanical design process is a systematic step-by-step approach from known specification to unknown solution

3.1.6. Planning for project design

Project design is the chronological vertical structure of the various phases or steps together from the project analysis to the retirement of the product. Thus Project of design includes the following steps:

(i) Feasibility Study:

The aim is to produce a number of feasible and useful solutions. Here the alternatives are assessed in stages. The first stage is madeon the basis of common sense. Many of the broad solutions may not be worth consideration. Considering technical feasibility some of the solutions can be eliminated. The last stage is the economic assessment. Systematic technical, economic, social and legal considerations provide a rapid

convergence towards the useful solutions.

(ii) Preliminary Design:

Feasibility study yields a set of useful solutions. The aim in this phase is to choose the optimal solution. To do this, criterion of optimization must be explicitly delineated. The chosen alternative is then tested and predictions are made concerning its performance.

(iii)Detailed Design:

The purpose of the detailed design is to produce a complete project description of a tested and producible design for manufacture. A detailed design includes manufacturing drawings with tolerances. Planning for Manufacturing-A procedure sheet is to be made which contains sequence of manufacturing operations that must be performed on the
component. It specifies clearly the tooling, fixtures and production projects. This phase may include planning, and inventory control, quality control system, the fixing of standard time and labor cost for each operation.

(iv) **Planning for Distribution, Use of the Product:**

The success ofa design depends on the skill exercised in marketing the product. Also the user-oriented concern such as reliability, ease of maintenance, product safety, and convenience in use, aesthetic appeal, economy and durability must meet.

3.2 Design of project

3.2.1 Motor calculation

One of the most important laws of physics is the fundamental Ohm's Law. It states that current through the conductor is directly proportional to applied voltage and is expressed as:

$$I = V / R$$

Where,
I – Current, measured in amperes (A);
V – Applied voltage, measured in volts (V);
R – Resistance, measured in ohms (Ω).

Calculate the resistance of your motor by measuring the consumed current and applied voltage. For any given resistance (in the motors it is basically the resistance of the coil) this formula explains that the current can be controlled by applied voltage.

The consumed electrical power of the motor is defined by the following formula:

$$Pin = I * V$$

Where,
Pin – Input power, measured in watts (W);
I – Current, measured in amperes (A);
V – Applied voltage, measured in volts (V).

Motors supposed to do some work and two important values define how powerful the motor is. It is motor speed and torque – the turning force of the motor. Output mechanical power of the motor could be calculated by using the following formula:

$$Pout = \tau * \omega$$

Where,
Pout – output power, measured in watts (W);
τ – Torque, measured in Newton meters (N•m);
ω – Angular speed, measured in radians per second (rad/s).

It is easy to calculate angular speed if you know rotational speed of the motor in rpm:

$\omega = rpm * 2\pi / 60$

Where,
ω – Angular speed, measured in radians per second (rad/s);
Rpm – rotational speed in revolutions per minute;
π – Mathematical constant pi (3.14).
60 – Number of seconds in a minute.

If the motor has 100% efficiency all electrical power is converted to mechanical energy. However such motors do not exist. Even precision made small industrial motors such as one we use as a generator in generator kit have maximum efficiency of 50-60%. Motors built from our kits usually have maximum efficiency of about 15% . Efficiency of the motor is calculated as mechanical output power divided by electrical input power:

$E = Pout / Pin$

Therefore

$Pout = Pin * E$

After substitution we get

$\tau * \omega = I * V * E$

$\tau * rpm * 2\pi / 60 = I * V * E$

and the formula for calculating torque will be

$\tau = (I * V * E * 60) / (rpm * 2\pi)$

Measure current, voltage and rpm. Now you can calculate the torque for this load at this speed assuming that you know efficiency of the motor.

Our estimated 15% efficiency represents maximum efficiency of the motor which occurs only at a certain speed. Efficiency may be anywhere between zero and the maximum; in our example below 1000 rpm may not be the optimal speed so the for the sake of calculations you may use 10% efficiency (E = 0.1).

Speed is 30 rpm, voltage is 12 Volts, and current is 800 mA (0.8 A):

$\tau = (0.8 * 12 * 0.1 * 60) / (30 * 2 * 3.14) = 0.15$ N•m

As the result is small usually it is expressed in milliNewton meters (mN•m). There is 1000 mN•m in 1 N•m, so the calculated torque is 151 mN•m.

The input electrical power of the motor is 0.8 A x 12 V = 9.6 W,
The Output mechanical power is 30 rpm x 2 x 3.14 x 0.15 N•m /60 = 9.4 W.

Motor torque changes with the speed. At no load you have maximum speed and zero torque. Load adds mechanical resistance. The motor starts to consume more current to overcome this resistance and the speed decreases. If you increase the load at some point motor stops (this is called stall). When it occurs the torque is at maximum and it is called stall torque.

Chapter 4

Manufacturing process of the project

4.1 Introduction

Manufacturing is the backbone of any industrialized nation. Manufacturing and technical staff in industry must know the various manufacturing processes, materials being processed, tools and equipment's for manufacturing different components or products with optimal process plan using proper precautions and specified safety rules to avoid accidents. Beside above, all kinds of the future engineers must know the basic requirements of workshop activities in term of man, machine, material, methods, money and other infrastructure facilities needed to be positioned properly for optimal shop layouts or plant layout and other support services effectively adjusted or located in the industry or plant within a well-planned manufacturing organization.

The complete understanding of basic manufacturing processes and workshop technology is highly difficult for anyone to claim expertise over it. The study deals with several aspects of workshops practices also for imparting the basic working knowledge of the different engineering materials, tools, equipment's, manufacturing processes, basic concepts of electro-mechanical controls of machine tools, production criteria's, characteristics and uses of various testing instruments and measuring or inspecting devices for checking components or products manufactured in various manufacturing shops in an industrial environment. It also describes and demonstrates the use of different hand tools (measuring, marking, holding and supporting tools, cutting etc.), equipment's, machinery and various methods of manufacturing that facilitate shaping or forming the different existing raw materials into suitable usable forms. It deals with the study of industrial environment which involves the practical knowledge in the area of ferrous and nonferrous materials, their properties and uses. It should provide the knowledge of basic workshop processes namely bench work and fitting, sheet metal, carpentry, pattern making, mould making, foundry, smithy, forging, metal working and heat treatment, welding, fastening, machine shop, surface finishing and coatings, assembling inspection and quality control. It emphasizes on basic knowledge regarding composition, properties and uses of different raw materials, various production processes, replacement of or improvement over a large number of old processes, new and compact designs, better accuracy in dimensions, quicker methods of production, better surface finishes, more alternatives to the existing materials and tooling systems, automatic and numerical control systems, higher mechanization and greater output.

Manufacturing is derived from the Latin word manufactus, means made by hand. In modern context it involves making products from raw material by using various processes, by making use of hand tools, machinery or even computers. It is therefore a study of the processes required to make parts and to assemble them in machines. Process Engineering, in its application to engineering industries, shows how the different problems related to development of various machines may be solved by a study of physical, chemical and other laws governing the manufacturing process. The study of manufacturing reveals those parameters which can be most efficiently being influenced to increase production and raise its accuracy.

4.1. Manufacturing Process

Manufacturing process is that part of the production process which is directly concerned with the change of form or dimensions of the part being produced. It does not include the transportation, handling or storage of parts, as they are not directly concerned with the changes into the form or dimensions of the part produced.

4.2.1. Classification of Manufacturing Processes

In the manufacturing processes used in manufacturing concern for changing the ingots into usable products may be classified into six major groups as primary shaping processes, secondary machining processes, metal forming processes, joining processes, surface finishing processes and processes effecting change in properties. These are discussed as under.

1. Primary Shaping Processes

Primary shaping processes are manufacturing of a product from an amorphous material. Some processes produces finish products or articles into its usual form whereas others do not, and require further working to finish component to the desired shape and size. Castings need re-melting of scrap and defective ingots in cupola or in some other melting furnace and then pouring of the molten metal into sand or metallic moulds to obtain the castings. The parts produced through these processes may or may not require undergoing further operations.

Some of the important primary shaping processes is:

(1) Casting, (2) Powder metallurgy, (3) Plastic technology, (4) Gas cutting, (5) Bending and (6) Forging.

2. Secondary or Machining Processes

As large number of components require further processing after the primary processes. These components are subjected to one or more number of machining operations in machine shops, to obtain the desired shape and dimensional accuracy on flat and cylindrical jobs. Thus, the jobs undergoing these operations are the roughly finished products received through primary shaping processes. The process of removing the undesired or unwanted material from the work piece or job or component to produce a required shape using a cutting tool is known as machining. This can be done by a manual process or by using a machine called machine tool (traditional machines namely lathe, milling machine, drilling, shaper, planner, spotter). In many cases these operations are performed on rods, bars and flat surfaces in machine shops.

These secondary processes are mainly required for achieving dimensional accuracy and a very high degree of surface finish. The secondary processes require the use of one or more machine tools, various single or multi-point cutting tools (cutters), job holding devices, marking and measuring instruments, testing devices and gauges etc. for getting desired dimensional control and required degree of surface finish on the workpiece. The example of parts produced by machining processes includes hand tools machine tools instruments, automobile parts, nuts, bolts and gears etc. Lot of material is wasted as scrap in the secondary or machining process. Some of the common secondary or machining processes are:

(1) Turning, (2) Threading, (3) Knurling, (4) Milling, (5) Drilling, (6) Boring, (7) Planning, (8) Shaping, (9) Slotting, (10) Sawing, (11) Broaching, (12) Hobbing, (13) Grinding, (14) Gear cutting, (15) Thread cutting and (16) Unconventional machining processes namely machining with Numerical Control (NC) machines tools or Computer Numerical Control (CNC) machines tools using ECM, LBM, AJM, USM setups etc.

3. Joining Processes

Many products observed in day-to-day life, are commonly made by putting many parts together may be in subassembly. For example, the ball pen consists of a body, refill, barrel, cap, and refill operating mechanism. All these parts are put together to form the product as a pen.

More than 800 parts are put together to make various subassemblies and final assembly of car or aero-plane. A complete machine tool may also require to assemble more than 100 parts in various sub assemble or final assembly. The process of putting the parts together to form the product, which performs the desired function, is called assembly. An assemblage of parts may require some parts to be joined together using various joining processes. But assembly should not be confused with the joining process. Most of the products cannot be manufactured as single unit they are manufactured as different components using one or more of the above manufacturing processes, and these components are assembled to get the desired product.

Joining processes are widely used in fabrication and assembly work. In these process two or more pieces of metal parts are joined together to produce desired shape and size of the product. The joining processes are carried out by fusing, pressing, rubbing, riveting, screwing or any other means of assembling. These processes are used for assembling metal parts and in general fabrication work. Such requirements usually occur when several pieces are to be joined together to fabricate a desired structure of products. These processes are used developing steam or water-tight joints. Temporary, semi-permanent or permanent type of fastening to make a good joint is generally created by these processes. Temporary joining of components can be achieved by use of nuts, screws and bolts. Adhesives are also used to make temporary joints. Some of the important and common joining processes are:

(1) Welding (plastic or fusion), (2) Brazing, (3) Soldering, (4) Riveting, (5) Screwing, (6) Press fitting, (7) Sintering, (8) Adhesive bonding, (9) Shrink fitting, (10) Explosive welding, (11) Diffusion welding, (12) Keys and cotters joints, (13) Coupling and (14) Nut and bolt joints.

4. Surface Finishing Processes

Surface finishing processes are utilized for imparting intended surface finish on the surface of a job. By imparting a surface finishing process, dimension of part is not changed functionally; a very negligible amount of material is removed from the certain material is added to the surface of the job. These processes should not be misunderstood as metal removing processes in any case as they are primarily intended to provide a good surface finish or a decorative or protective coating on to the metal surface. Surface cleaning process also called as a surface finishing process. Some of the commonly used surface finishing processes are: (1) Honing, (2) Lapping, (3) Super finishing, (4) Belt grinding, (5) Polishing, (6) Tumbling, (7) Organic finishes, (8) Sanding, (9) Debarring, (10) Electroplating, (11) Buffing, (12) Metal spraying, (13) Painting, (14) Inorganic coating, (15) Anodizing, (16) Sheradising, (17) Parkerizing, (18) Galvanizing, (19) Plastic coating, (20) Metallic coating, (21) Anodizing and (22) Sand blasting.

4.3. Product development process

A product development has to go through the following concepts of product engineering which are given as under.

- Product functions
- Product specifications
- Conceptual design
- Ergonomics and aesthetics
- Standards
- Detailed design
- Prototype development
- Testing
- Simulation
- Design for manufacture
- Design for assembly
- Drafting

4.4 Manufacturing process of the project

1. Measurement of the material required dimension:

Measurement is the foundation of scientific inquiry. In order to test our hypotheses, we must observe our theoretical concepts at the operational level. In simple words, we must measure what we have defined. But there are different levels of measurement, which provide differing amounts of information about the theoretical construct. There are also some basic issues about the adequacy of measurement which we must address.

2. Cutting operation as per dimension:

Cutting processes work by causing fracture of the material that is processed. Usually, the portion that is fractured away is in small sized pieces, called chips. Common cutting processes include sawing, shaping (or planning), broaching, drilling, grinding, turning and milling. Although the actual machines, tools and processes for cutting look very different from each other, the basic mechanism for causing the fracture can be understood by just a simple model called for orthogonal cutting.

In all machining processes, the work pieceis a shape that can entirely cover the final part shape. The objective is to cut away the excess material and obtain the final part. This cutting usually requires to be completed in several steps – in each step, the part is held in a fixture, and the exposed portion can be accessed by the tool to machine in that portion. Common fixtures include vise, clamps, 3-jaw or 4-jaw chucks, etc. Each position of holding the part is called a setup. One or more cutting operations may be performed, using one or more cutting tools, in each setup. To switch from one setup to the next, we must release the part from the previous fixture, change the fixture on the machine, clamp the part in the new position on the new fixture, set the coordinates of the machine tool with respect to the new location of the part, and finally start the machining operations for this setup. Therefore, setup changes are time-consuming and expensive, and so we should try to do the entire cutting process in a minimum number of setups; the task of determining the sequence of the individual operations, grouping them into (a minimum number of) setups, and determination of the fixture used for each setup, is called process planning.

3. Machining operation on required parts:

Turning is a cutting operation in which the part is rotated as the tool is held against it on a machine called a lathe. The raw stock that is used on a lathe is usually cylindrical, and the parts that are machined on it are rotational parts – mathematically, each surface machined on a lathe is a surface of revolution. Machining is an essential process of finishing by which work pieces are produced to the desired dimensions and surface finish by gradually removing the excess material from the preformed blank in the form of chips with the help of cutting tool(s) moved past the work surface(s).Most of the engineering components such as gears, bearings, clutches, tools, screws and nuts etc.need dimensional and form accuracy and good surface finish for serving their purposes. Performing like casting, forging etc. generally cannot provide the desired accuracy and finish. For that such preformed parts, called blanks, need semi-finishing and finishing and it is done by machining and grinding.

- Grinding is also basically a machining process.
- Machining to high accuracy and finish essentially enables a product:
- Fulfill its functional requirements.
- Improve its performance.
- Prolong its service

3. Drilling and tapping the material as per dimension:

These four methods all produce holes of different types. Drilling produces round holes of different types; reaming is used to improve the dimensional tolerance on a drilled hole; boring uses a special machine operating like a lathe, to cut high precision holes; and tapping creates screw-threads in drilled holes. Drilling: The geometry of the common twist drill tool (called drill bit) is complex; it has straight cutting teeth at the bottom – these teeth do most of the metal cutting, and it has curved cutting teeth along its cylindrical surface. The grooves created by the helical teeth are called flutes, and are useful in pushing the chips out from the hole as it is being machined. Clearly, the velocity of the tip of the drill is zero, and so this region of the tool cannot do much cutting. Therefore it is common to machine a small hole in the material, called a center-hole, before utilizing the drill. Center-holes are made by special drills called center-drills; they also provide a good way for the drill bit to get aligned with the location of the center of the hole. There are hundreds of different types of drill shapes and sizes; here, we will only restrict ourselves to some general facts about drills.

- Common drill bit materials include hardened steel (High Speed Steel, Titanium Nitride coated steel); for cutting harder materials, drills with hard inserts, e.g. carbide or CBN inserts, are used;

- In general, drills for cutting softer materials have smaller point angle, while those for cutting hard and brittle materials have larger point angle;
- If the Length/Diameter ratio of the hole to be machined is large, then we need a special guiding support for the drill, which itself has to be very long; such operations are called gun-drilling. This process is used for holes with diameter of few mm or more, and L/D ratio up to 300. These are used for making barrels of guns;
- Drilling is not useful for very small diameter holes (e.g.< 0.5 mm), since the tool may break and get stuck in the workpieces;
- Usually, the size of the hole made by a drill is slightly larger than the measured diameter of the drill – this is mainly because of vibration of the tool spindle as it rotates, possible misalignment of the drill with the spindle axis, and some other factors;
- For tight dimension control on hole diameter, we first drill a hole that is slightly smaller than required size (e.g. 0.25 mm smaller), and then use a special type of drill called a reamer. Reaming has very low material removal rate, low depth of cut, but gives good dimension accuracy;
- large and deep holes are made by spade drills;
- Countersink/counter bore drills have multiple diameters – they make a chamfered/stepped hole, which is useful for inserting screws/bolts – the larger diameter part of the hole accommodates the screw/bolt head;
- Internal threads can be cut into holes that mate with screws/bolts. These are cut by using tapping tools.

4. Welding the material as per dimension:

Welding is a process for joining two similar or dissimilar metals by fusion. It joins different metals/alloys, with or without the application of pressure and with or without the use of filler metal. The fusion of metal takes place by means of heat. The heat may be generated either from combustion of gases, electric arc, electric resistance or by chemical reaction. During some type of welding processes, pressure may also be employed, but this is not an essential requirement for all welding processes. Welding provides a permanent joint but it normally affects the metallurgy of the components. It is therefore usually accompanied by post weld heat treatment for most of the critical components. The welding is widely used as a fabrication and repairing process in industries. Some of the typical applications of welding include the fabrication of ships, pressure vessels, automobile bodies, off-shore platform, bridges, welded pipes, sealing of nuclear fuel and explosives, etc. Most of the metals and alloys can be welded by one type of welding process or the other.

However, some are easier to weld than others. To compare this ease in welding term

- 'Weld ability' is often used. The weld ability may be defined as property of a metal which indicates the ease with which it can be welded with other similar or dissimilar metals.
- Weld ability of a material depends upon various factors like the metallurgical changes that occur due to welding, changes in hardness in and around the weld, gas evolution and absorption, extent of oxidation, and the effect on cracking tendency of the joint. Plain low carbon steel has the best weld ability amongst metals. Generally it is seen that the materials with high cast ability usually have low weld ability.

5. Grinding the project welding joints:

There are several types of grinding machines. The main ones are surface grinders, grinding wheels, cylindrical grinders and center less grinders. The figure below shows examples of a few of these. Surface grinders produce flat surfaces. The part is held on the flat table (steel parts can be held by a magnetic force – this is called ***magnetic chucking***). The table moves in a reciprocating motion, and the rotating wheel is lowered so that it just scrapes along the surface.

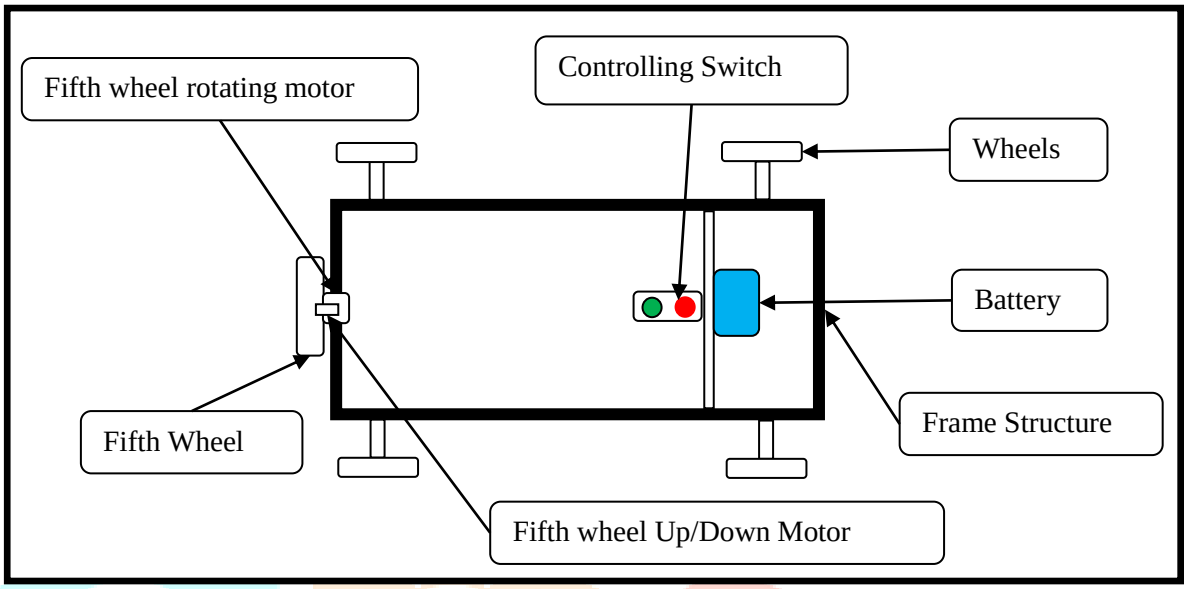
To improve dimension control on cylindrical parts, center less grinders, which use long cylindrical wheels, are employed. The axis of the regulating wheel and grinding wheel are slightly misaligned, causing the part to travel slowly in the axial direction, and after some time, the part automatically moves beyond the length of the wheel. Controlling the angle of misalignment can control the time that the part is subjected to

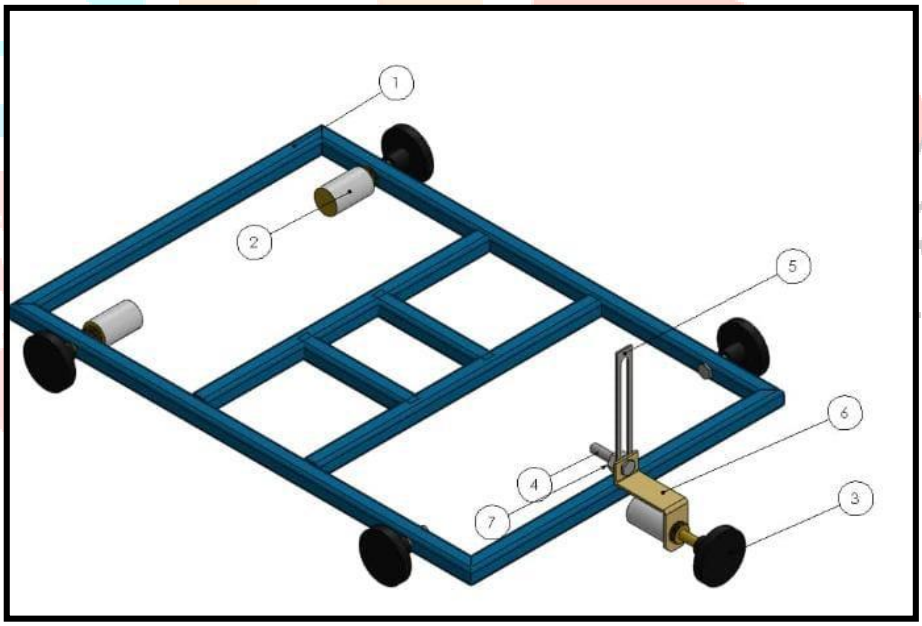
grinding. If a turned part of complex shape (e.g. stepped shafts) are to be ground, then cylindrical grinding is used, which employs specially made grinding wheels, whose profile fits the profile of the part to be ground.

Chapter 5

Construction & Working of Project:

5.1 Design and Drawing





5.2 Part and there Specifications:

1. Frame:

- Mild steel pipe 1 inch, Square pipe
- Dimension 18 inch width, 22 inch length

2. Motor:

- Rated Voltage:12 Volt DC
- Rated Power: 9.6 W
- RPM (After Reduction) – 30rpm.
- Rated Current– 0.8 A
- Full load current–7. 5 A

- Under voltage protection: 24.5V
- Rated Torque : 0.15 Nm
- Gear ratio 1:300

3. Wheel:

- Rubber type 4 inch diameter

4. Screw:

- Material : Mild steel
- Size: 14mm
- Thread : 1 mm pitch, diameter 14mm

5. Battery:

- Rated Voltage:12Volt DC
- Rated Power:7.2 Ampere

Describes the Working of components:

1. PMDC Motor

In a DC motor, an armature rotates inside a magnetic field. The basic working principle of a DC motor is based on the fact that whenever a current carrying conductor is placed inside a magnetic field, there will be mechanical force experienced by that conductor. All kinds of DC motors work under this principle. Hence for constructing a DC motor, it is essential to establish a magnetic field. The magnetic field is established by using a magnet. You can use different types of magnets – it may be an electromagnet or it can be a permanent magnet

A Permanent Magnet DC motor (PMDC motor) is a type of DC motor that uses a permanent magnet to create the magnetic field required for the operation of a DC motor. Thus permanent magnet DC motor is used where there is no need to control the speed of the motor (which is usually done by controlling the magnetic field). Small fractional and sub-fractional KW motors are often constructed using a permanent magnet.

2. Battery:

An electric battery is a source of electric power consisting of one or more electrochemical cells with external connections for powering electrical devices. When a battery is supplying power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy. Historically the term "battery" specifically referred to a device composed of multiple cells; however, the usage has evolved to include devices composed of a single cell.

Primary (single-use or "disposable") batteries are used once and discarded, as the electrode materials are irreversibly changed during discharge; a common example is the alkaline battery used for flashlights and a multitude of portable electronic devices. Secondary (rechargeable) batteries can be discharged and recharged multiple times using an applied electric current; the original composition of the electrodes can be restored by reverse current. Examples include the lead-acid batteries used in vehicles and lithium-ion batteries used for portable electronics such as laptops and mobile phones.

Batteries come in many shapes and sizes, from miniature cells used to power hearing aids and wristwatches to, at the largest extreme, huge battery banks the size of rooms that provide standby or emergency power for telephone exchanges and computer data centers. Batteries have much lower specific energy (energy per unit mass) than common fuels such as gasoline. In automobiles, this is somewhat offset by the higher

efficiency of electric motors in converting electrical energy to mechanical work, compared to combustion engines

Batteries convert chemical energy directly to electrical energy. In many cases, the electrical energy released is the difference in the cohesive or bond energies of the metals, oxides, or molecules undergoing the electrochemical reaction.[3] For instance, energy can be stored in Zn or Li, which are high-energy metals because they are not stabilized by d-electron bonding, unlike transition metals. Batteries are designed so that the energetically favorable redox reaction can occur only when electrons move through the external part of the circuit.

A battery consists of some number of voltaic cells. Each cell consists of two half-cells connected in series by a conductive electrolyte containing metal cations. One half-cell includes electrolyte and the negative electrode, the electrode to which anions (negatively charged ions) migrate; the other half-cell includes electrolyte and the positive electrode, to which cations (positively charged ions) migrate. Cations are reduced (electrons are added) at the cathode, while metal atoms are oxidized (electrons are removed) at the anode. Some cells use different electrolytes for each half-cell; then a separator is used to prevent mixing of the electrolytes while allowing ions to flow between half-cells to complete the electrical circuit.

Each half-cell has an electromotive force (emf, measured in volts) relative to a standard. The net emf of the cell is the difference between the emfs of its half-cells. The electrical driving force across the terminals of a cell is known as the terminal voltage (difference) and is measured in volts. The terminal voltage of a cell that is neither charging nor discharging is called the open-circuit voltage and equals the emf of the cell. Because of internal resistance, the terminal voltage of a cell that is discharging is smaller in magnitude than the open-circuit voltage and the terminal voltage of a cell that is charging exceeds the open-circuit voltage. An ideal cell has negligible internal resistance, so it would maintain a constant terminal voltage of until exhausted, then dropping to zero. If such a cell maintained 1.5 volts and produce a charge of one coulomb then on complete discharge it would have performed 1.5 joules of work.In actual cells, the internal resistance increases under discharge and the open-circuit voltage also decreases under discharge. If the voltage and resistance are plotted against time, the resulting graphs typically are a curve; the shape of the curve varies according to the chemistry and internal arrangement employed.

3. Wheels:

A wheel is a circular component that is intended to rotate on an axle bearing. The wheel is one of the key components of the wheel and axle which is one of the six simple machines. Wheels, in conjunction with axles, allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labor in machines. Wheels are also used for other purposes, such as a ship's wheel, steering wheel, potter's wheel and flywheel.

Common examples are found in transport applications. A wheel greatly reduces friction by facilitating motion by rolling together with the use of axles. In order for wheels to rotate, a moment needs to be applied

to the wheel about its axis, either by way of gravity or by the application of another external force or torque. Using the wheel, Sumerians invented a contraption that spins clay as a potter shapes it into the desired object The place and time of the invention of the wheel remains unclear, because the oldest hints do not guarantee the existence of real wheeled transport, or are dated with too much scatter. Mesopotamian civilization is credited with the invention of the wheel. However, unlike other breakthrough inventions, the wheel cannot be attributed to a single nor several inventors. Evidence of early usage of wheeled carts have been found across the Middle East, in Europe, Eastern Europe, and China. It is not known whether Chinese and Europeans invented the wheel independently or not.

4. Nut / Bolts:

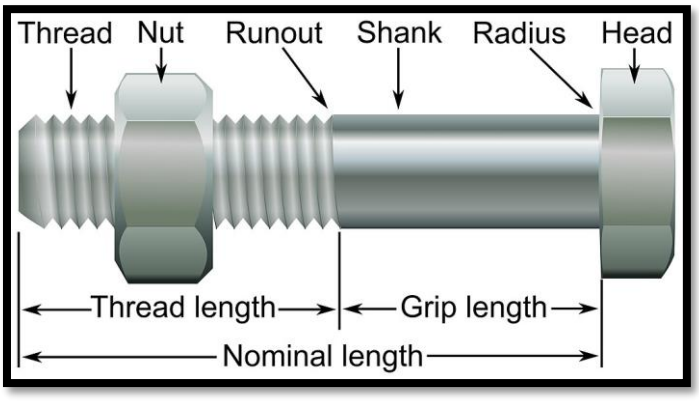
A nut is a type of fastener with a threaded hole. Nuts are almost always used in conjunction with a mating bolt to fasten multiple parts together. The two partners are kept together by a combination of their threads' friction (with slight elastic deformation), a slight stretching of the bolt, and compression of the parts to be held together.

In applications where vibration or rotation may work a nut loose, various locking mechanisms may be employed: lock washers, jam nuts, specialist adhesive thread-locking fluid such as Loctite, safety pins (split pins) or lockwire in conjunction with castellated nuts, nylon inserts (nyloc nut), or slightly oval-shaped threads.

Square nuts, as well as bolt heads, were the first shape made and used to be the most common largely because they were much easier to manufacture, especially by hand. While rare today[when?] due to the reasons stated below for the preference of hexagonal nuts, they are occasionally used in some situations when a maximum amount of torque and grip is needed for a given size: the greater length of each side allows a spanner to be applied with a larger surface area and more leverage at the nut.

The most common shape today is hexagonal, for similar reasons as the bolt head: six sides give a good granularity of angles for a tool to approach from (good in tight spots), but more (and smaller) corners would be vulnerable to being rounded off. It takes only one sixth of a rotation to obtain the next side of the hexagon and grip is optimal. However, polygons with more than six sides do not give the requisite grip and polygons with fewer than six sides take more time to be given a complete rotation. Other specialized shapes exist for certain needs, such as wingnuts for finger adjustment and captive nuts (e.g. cage nuts) for inaccessible areas.

A wide variety of nuts exists, from household hardware versions to specialized industry-specific designs that are engineered to meet various technical standards. Fasteners used in automotive, engineering, and industrial applications usually need to be tightened to a specific torque setting, using a torque wrench. Nuts are graded with strength ratings compatible with their respective bolts; for example, an ISO property class 10 nut will be able to support the bolt proof strength load of an ISO property class 10.9 bolt without stripping. Likewise, an SAE class 5 nut can support the proof load of an SAE class 5 bolt, and so on.



A bolt is a form of threaded fastener with an external male thread requiring a matching pre-formed female thread such as a nut. Bolts are very closely related to screws

5. Mild Steel. Pipe

A pipe is a tubular section or hollow cylinder, usually but not necessarily of circular cross section, used mainly to convey substances which can flow liquids and gases (fluids), slurries, powders and masses of small solids. It can also be used for structural applications; hollow pipe is far stiffer per unit weight than solid members.

In common usage the words pipe and tube are usually interchangeable, but in industry and engineering, the terms are uniquely defined. Depending on the applicable standard to which it is manufactured, pipe is generally specified by a nominal diameter with a constant outside diameter (OD) and a schedule that defines the thickness. Tube is most often specified by the OD and wall thickness, but may be specified by any two of OD, inside diameter (ID), and wall thickness. Pipe is generally manufactured to one of several international and national industrial standards.[1] While similar standards exist for specific industry application tubing, tube is often made to custom sizes and a broader range of diameters and tolerances. Many industrial and government standards exist for the production of pipe and tubing. The term "tube" is also commonly applied to non-cylindrical sections, i.e., square or rectangular tubing. In general, "pipe" is the more common term in most of the world, whereas "tube" is more widely used in the United States.

Both "pipe" and "tube" imply a level of rigidity and permanence, whereas a hose (or hosepipe) is usually portable and flexible. Pipe assemblies are almost always constructed with the use of fittings such as elbows, tees, and so on, while tube may be formed or bent into custom configurations. For materials that are inflexible, cannot be formed, or where construction is governed by codes or standards, tube assemblies are also constructed with the use of tube fittings.

Chapter 6

Concluding Remarks and Scope for the Future Work:

6.1 Conclusion:

The project carried out by us made an impressing task in the field of automobile industries. It is very usefully for driver while driving the vehicle and parking the vehicle. This project has also reduced the cost involved in the concern. Project has been designed to perform the entire requirement task which has also been provided. A vehicle featuring low cost and user-friendly steering mechanism for Auxiliary wheel has been introduced. This paper focused on a steering mechanism which offers feasible solutions to a number of current maneuvering limitations. A prototype for the proposed approach was developed by introducing separate mechanism for normal steering purpose and 360-degree steering purpose. This prototype was found to be able to be maneuvered very easily in tight spaces, also making 360◦ steering possible.

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6.2 Future scope:

i. Aim for development of a system to useful in the automotive sector.
ii. Four bar mechanism will be implementing for working of fifth wheel, our aim is to fold the fifth wheel axel for better space adaptability.
iii. Hence whenever needed operated must have unfold the fifth wheel axel by actuating rack and pinion.
iv. Arrange conventional steering system at front side

6.3 Advantages:

i. Easy Maintenance
ii. Change in mode is Easy
iii. Applicable in every 4 wheeler
iv. To obtain better parking in narrow space and at multiplexes.
v. To obtain 0 to 360 degree turning with zero turning radius.
vi. Resolve Traffic Problems.
vii. Vehicle parking and driving in city conditions with heavy traffic in tight spaces.
viii. This type of car can be taken through traffic jam.
ix. Saving of Time.

6.4 Disadvantages:

i. Additional wheel is required
ii. ii. Extra space is required
iii. iii. Less boot space

6.5 Application of project:

i. Used for easy parking in four wheelers
ii. It is applicable for all four wheeled vehicles.

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