ANTI-THEFT CAR SEAT DESIGN (ELECTRONIC/CONTROL)

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Report submitted in fulfilment of the requirements
for the award of the degree of
Bachelor of Mechanical Engineering with Automotive Engineering

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SUPERVISOR'S DECLARATION

SUPERVISOR'S DECLARATION

I hereby declare that I have checked this project and in my opinion, this project is adequate in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering with Automotive Engineering.

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STUDENT'S DECLARATION

I hereby declare that the work in this project is my own except for quotations and summaries which have been duly acknowledged. The project has not been accepted for any degree and is not concurrently submitted for award of other degree.

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In the Name of Allah, The Most Beneficent, The Most Merciful

Dedicate to my beloved parents and brothers

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ABSTRACT

The purpose of this project is to investigate the application of motor control system that suit to the new movement mechanism of driver car seat. The objective of this project is to design control circuit and integrate electric and electronic devices to the mechanism of the anti theft car seat. This Project involved of Infrared Transmitter circuit and Infrared Receiver circuit of 12 volts DC Motor. The motor will rotate bidirectional due the command of code that has been installing in the microcontroller. The coding inside the microcontroller has been programmed by using the Visual Basic software. PICAXE14M microcontroller has been selected for the control circuit because it is very appropriate with this control circuit system and PICAXE14M also good for the motor controller. 12 volt of DC motor is connected to control a new mechanism of seat movement which is rack and pinion gearing system and Internal gearing system. The rack and pinion gearing system is the system for the movement forward and backward of the car seat whiles the internal gearing system for bend the backrest of the seat down and up. Both of this mechanism involved of same types of gearing profiles. The types of gear used in this mechanism are the spur gear. A pair of spur gear is mesh together. One essential for correct meshing of the gears is that the size of the teeth on the pinion is the same as the size of teeth on the wheel. The pinion is the smallest gear and the larger gear is called the gear wheel .The 10 teeth of the smaller pinion and the 20 teeth of the wheel lay to the parallel axes. The module types used in this gearing system are 1 module. Module is the unit of size that indicates how big or small gear is. It is the ratio of the reference diameter of the gear divided by the number of teeth. The 20 teeth of gear wheel are coupled together with the 40 teeth of gear as the output gear. The purpose used the 40 teeth of output gear because of the gear reduction. The output speed of a DC motor is usually too fast for normal used. Most DC motors at normal operating voltages spin at high RPM or revolutions per minute so it is really necessary to reduce the rate at the wheel spins to suit the normal movement of seat. The gear reduction also can increase the torque of the motor to the output gear. This output gear is attached and mesh together with a rack and the internal gear. A rack is a rectangular prism with gear teeth machined along one side. The internal gear is hollow. The profile and teeth shape is similar as of external gear except that the internal gear had different addendum and dedendum values modified to prevent interference meshes. They are used in planetary gears to produce large reduction ratios. The gear ratio is the relationship between the numbers of teeth on two gears that are meshed. In this project all the gear ratio is 1:2.The simulation of the gearing system done by using the SolidWorks software. Solidworks is a 3D mechanical CAD or computer aided design program that runs on Microsoft window. The obtained result in this project also considered whether it is suitable to make the car seat as the new anti theft device for the future. All the suggestion and recommendation to improve this project had been written in the last chapter.

ABSTRAK

Projek ini bertujuan untuk mengkaji aplikasi sistem kawalan motor yang bersesuaian dengan sistem pergerakan baru tempat duduk pemandu. Objektif projek ini untuk mereka litar kawalan dan untuk menaikkan keupayaan sistem elektronik dan elektrik kerusi anti pencuri. Projek ini merangkumi penggunaan litar penghantar infra merah dan penerima infra merah oleh 12V motor arus terus. Dengan berpandukan arahan daripada kod yang telah diprogramkan didalam pengawal mini menggunakan perisian *Visual Basic*, motor tersebut akan berputar dua arah. Pengawal mini PICAXE14M dipilih kerana ianya bersesuaian dengan sistem kawalan mekanisma projek ini. 12V motor disambungkan kepada mekanisma baru pergerakan kerusi iaitu sistem gear dalaman dan '*rack and pinion'*. Sistem gear rack and pinion berfungsi menggerakkan kerusi kehadapan dan kebelakang manakala sistem gear dalaman pula untuk menaik dan menurunkan bahagian bersandar kerusi. Kedua-dua sistem gear ini adalah daripada jenis profil gear yang sama iaitu gear taji di mana sepasang gear taji digabungkan bersama. Saiz gear taji mestilah sama antara satu sama lain bagi mendapatkan cantuman dan pusingan gear tersebut. Gear terkecil (saiz gigi 10) adalah gear pinion manakala yang terbesar adalah gear pemacu(saiz gigi 20) dan ianya berada pada paksi selari. *Modul* 1 adalah jenis kumpulan saiz untuk menentukan nisbah bilangan gigi gear antara gear lain yang digabungkan. Gear gigi 40 digunakan sebagai gear pengurangan hasil keluaran. Kebiasaannya hasil motor arus terus adalah lebih cepat daripada kegunaan biasa. Oleh itu, adalah penting untuk mengurangkan voltan supaya kadar pusingan roda dapat disesuaikan dengan pergerakan normal mekanisma kerusi tersebut. Pengurangan gear tersebut juga akan meningkatkan nilai daya kilasan pada gear keluaran. Gear keluaran ini kemudiannya dicantumkan serta digabungkan bersama *rack* dan gear dalaman. *'Rack'* adalah prisma dengan gigi gear dimesinkan pada sepanjang satu bahagian. Gear dalaman adalah jenis berlubang. Profil dan bentuk gigi adalah sama dengan gear luaran kecuali gear dalaman mempunyai nilai addendum dan dedendum yang dibaik pulih untuk mencegah sebarang ralat semasa gear digabungkan. Ianya digunakan dalam gear planetary untuk menghasilkan nilai pengurangan nisbah yang besar. Nisbah gear adalah nilai antara no gigi antara 2 gear. Projek ini menggunakan nisbah 1:2. Simulasi untuk gear ini dihasilkan menggunakan perisian *Solidworks* di mana ianya adalah lukisan 3 dimensi terbantu komputer *(CAD)* yang dihasilkan didalam *Microsoft*. Keputusan yang diperolehi didalam projek ini juga mengambil kira kesesuaian mekanisma baru kerusi anti pencuri pada masa hadapan dapat diguna pakai atau tidak. Semua cadangan dan penambahbaikkan untuk menigkatkan keberkesanan projek ini dinyatakan didalam bab terakhir tesis ini.

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LIST OF SYMBOLS

ω	Angular velocity
Ω	Ohm
Π	Pi
V	Volt
A	Ampere
K	Kilo
N	Newton
M	Meter
m	mili
H	Horse Power
Wt	Transmitted Load
^{o}	Degree
T	Torque
Ft	Tangential Force
Fr	Radial Force
α	Pressure Angle

LIST OF ABBREVIATIONS

LEDs	Light Emitted Diodes
DC	Direct Current
RPM	Radian Per Minute
RAD/S	Radian Per second
FEA	Finite Element Analysis
U.S	United States
IR	Infrared
RF	Radio Frequency
VCR	Digital Video Recorder
DVD	Digital Video Player
TV	Television
AC	Alternative Current

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

This chapter presents an overview of dissertation including a brief introduction to an Anti thief Design of car seat in terms of control and electronic and the project flow of the design. This chapter also gives explanation about the background and the problem statement. The objective, project scope and the significant of this project are also included in this chapter.

According to recent statistic locally, over a million vehicles were stolen each year. Vehicles were parked on the street or in parking lots, door unlocked, windows wide open and nobody worried about their car getting stolen even though there are several parties still consider or take serious about the car's security system but this phenomenon still happened and become big issue nowadays. Consequently of these increasing issues, anti-thief devices have become so sophisticated. Although there are so many high technologies anti–thief devices invention, it still can be circumvented by the professional thief.

In Malaysia, Statistics have shown that in the first six months of 2004, 35888 vehicles were stolen, leading to RM357 million in losses. Vehicle theft contributes 45% that almost half of the country's overall crime index for the first half of this year. This was an increase from 41% in year 2003. (See Figure 1.1)

On average, it takes a carjacker 3 minutes to steal the car, and within the next half an hour it could be already stripped and sold for spare parts or shipped out of the country as far as South Africa.

A stolen car is driven to a warehouse where it is sprayed a new layer of paint, and chassis and registration numbers are altered if it is decided to be shipped out of the country to be sold. Vehicles stolen near the borders like Johor are usually driven out of the country immediately after the preparation and efforts by the police to recover the vehicles are unsuccessful due to lack of cooperation by the neighbor countries.

Vehicle Models Reported Stolen in Malaysia

	Cars			
	2004		2003	
Year/Model	Stolen	Recovered	Stolen	Recovered
Proton	4,097	1,642	4,197	1,495
Perodua	1,091	352	1,054	272
Toyota	946	249	1,327	262
Nissan	481	138	579	157
Honda	322	161	481	133
Mitsubishi	227	77	240	41
Mazda	119	44	135	34
Ford	95	22	133	27
M/Benz	72	48	73	44
Daihatsu	47	15	68	23
BMW	26	11	30	4
Volvo	16	5	15	1
Suzuki	15	2	16	4
Others	268	68	189	50
Total	7,822	2,834	8,537	2,547

Figure 1.1: Report of Stolen vehicles in Malaysia

Any vehicle could be stolen, regardless of the age or condition it is in. Cars are taken to sell to others, be turned in for parts or for a quick joy ride or crime spree. According to many car thieves, the first thing they look for is easy access. That means a car that is not locked nor has the windows rolled down is more likely to be stolen than one that is properly closed and locked up.

After spreading the vehicles theft phenomenon and the frequent tricks of thieves had gone beyond the security system of the vehicles. One innovative way to improve car security is to design an anti-theft car seat. Anti-theft car seat help car user to lock the driver seat at a non-drivable position. The mechanism involves dc motor and lead screw as well as other components controlled by a motor driver circuit. This project focuses on the control circuit design as well as the electrical and electronic adaptation to mechanical assembly design.

1.2 PROBLEM STATEMENT

The automotive security system industry is flooded with devices that offer various method and devices of theft prevention but never use driver seat as the protection to install the devices. Anti theft device also usually implemented partially and prone to tempering. By having anti-theft car seat, car user does not need to have additional deterrent devices. My project is focus on how to design mechanism for this seat requires an electronic control for it to be feasible. The suitable circuit design and proper integration to seat mechanism is crucial for make the user easier to control the anti theft car seat.

1.3 OBJECTIVE OF THE PROJECT

1. To design control circuit and to integrate electric/electronic devices to the mechanism of the anti theft car seat
2. To determine the best way to implement control electronics to suit conventional car seat design.

1.4 SCOPE OF THE PROJECT:

1. Access to other method of automation
2. Re-design circuit for control
3. Study about Microcontroller and the gearing system
4. Fabricate the control circuit.

1.5 SIGNIFICANCE OF PROJECT:

Safety feature is one of the important aspects of a car especially to prevent the car from be stolen. It is also to prevent loss of money, time and life. The car user can do a lot to protect their car from theft or break-ins by using this anti theft car seat. The significance is this device fulfilled the entire requirement needed as the anti theft.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of this chapter is providing a review about the study and research elaborations related to the project.

2.1.1 History of Seat Design

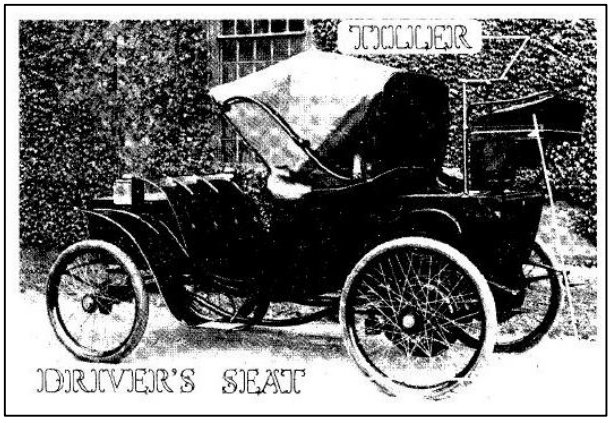


Figure 2.1: Driver's seat: Horseless carriage

Figure 2.0, shows the first automotive seat, it was adaption from the horse-drawn carriage. At this time, this seat does not have springs system to absorb road shocks, the system were primitive, effective padding was non-existent. Besides that, the adjustability also had not yet been considered.

In 1990s, the safety of the occupants had been considerate even is not complete yet. Development of deeply contoured seat that reduce likely-hood of motorist ejection as the car body pitched and rolled while traveling over rough road.

Before 1929, front seat fore-and-aft adjustment was not available yet, but commencing around 1929 front seat for driver became a feature of higher priced automobiles. Occupant comfort was given increased attention as engineering problem concerning motor vehicle s performance and reliability became more effective managed.

The improvement of seat design continued until mid 1930's, seat, tracks and runners closely resembled those of mid 1960's.Between this period, early 1950's the introduction of power seat and adjustable reclining backrests is the only significant innovation they have. (See Table 2.1 and figure 2.2)

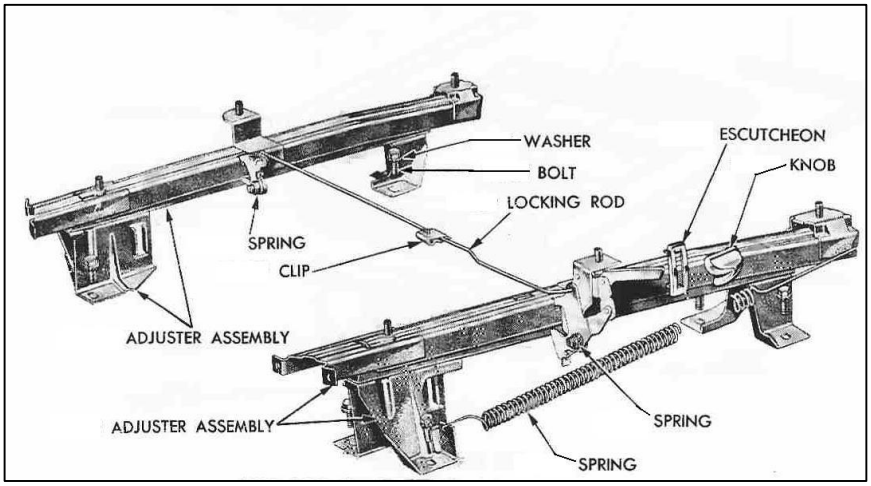


Figure 2.2: Power seat

Table 2.1: Seat Evolution Design

Introduced	Item	Example
1890-1900	Automotive Bench seat	Philon
1900-1910	Deep Bucket seat	Thomas
1900-1915	Fold-forward Backrests	Model T-ford
	Console between seat	Wesscott
	Pedestal seat	Argo electric
1915-1920	Swivel seat	Cole
1920-1925	Fold-down armrest	Dusenberg
1925-1930	Fore-and-aft Adjustment	Viking
1950-1952	Power seats	Packard
1960-1963	Optional Head Restrains	All U.S
1968	Integrated Head Restrains	Volkswagen
1969	Standard Head Restrains	All U.S

In the late 1960's seatback height reached reasonable levels but in mid seventies the height of backrests on many models had declined to levels less effective than thirty years ago. Seatback strength has not increased over the past thirty years and remains inadequate resists even moderate collision force. The backrests head support standard such as FMVSS 202 has been compromised the remarkable safety improvement facilitated. This standard system had through failure to upgrade criteria to maintain performance commensurate with intent. Seventy percent of adjustable head restraints are used in down most position. The head restrains is positioned behind or slightly above the head and remains in support position during collision.

2.1.2 Power Seats

Many vehicles today have power seats that moves the front seats upward,downward,forward,and backward.Many vehicles also use support mats within the seat to fit its shape to the driver or passenger.It can be adjust by using a swicth or joystick and a set of small electric motor. The switch is located on the lower outbaoard side of the seat cushion on the seat cushion side .The individual switches in the power seat switch unit cannot be repaired . If one switch is damaged or faulty , the entire power seat switch unit must be replaced.

2.1.3 Description And Operation

2.1.3.1 Power Seat Switch

Power seat system may have two-way,four-way,six-way,or eight-way adjustment.Depending on which option the vechicle is eqquipped with,the seat can be moved.

1. Two-way systems move forward and backward(see figure 2.3)
2. Four-way system move forward,back-ward and front edge up and down
3. Six way system used in most late-model applications,move the entire seat forward,backward.up and down(see figure 2.3)

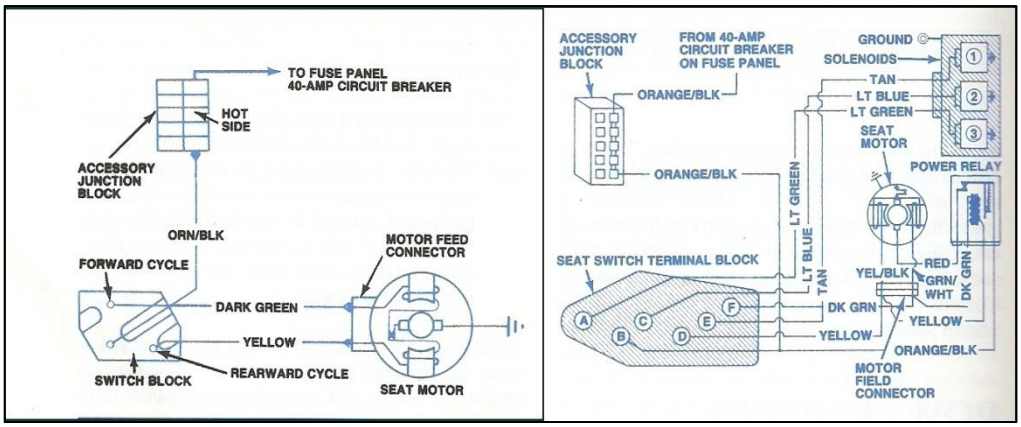


Figure 2.3: (left)Two-way power seat system.and (right)six-way power seat system.

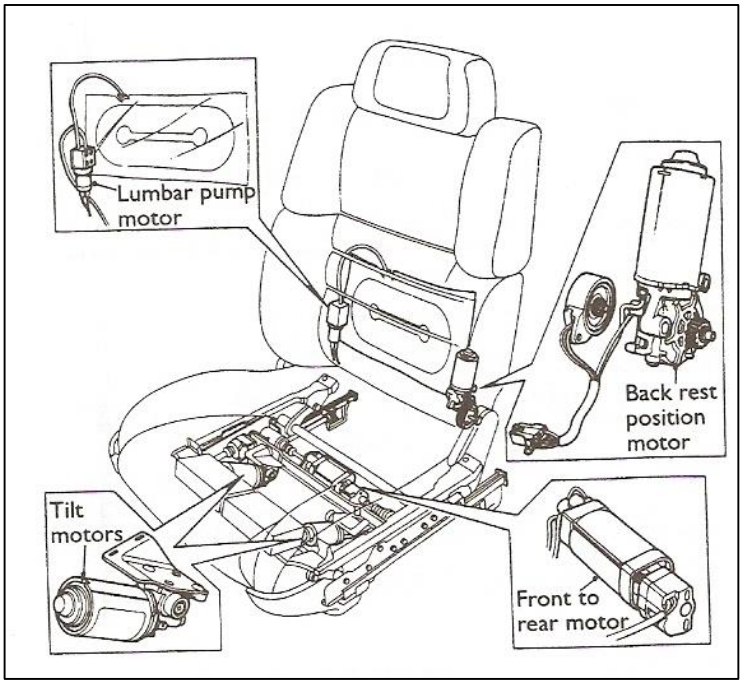


Figure 2.4:Electrically controlled seat.

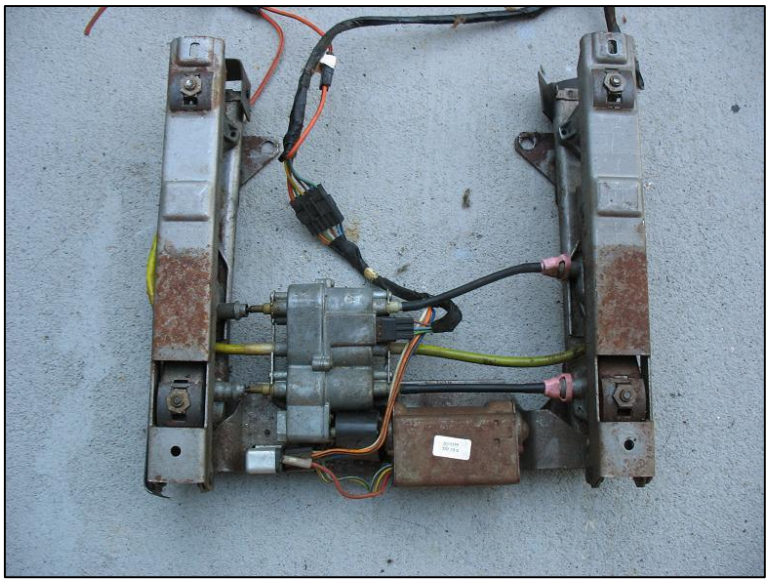


Figure 2.5:Real life electronic seat adjustment

Picture shows a power seat from a 73 Olds 98 2dr with split front bench seat. Notice there is 6 cables connected to the transmission. This is a 6 way power seat.

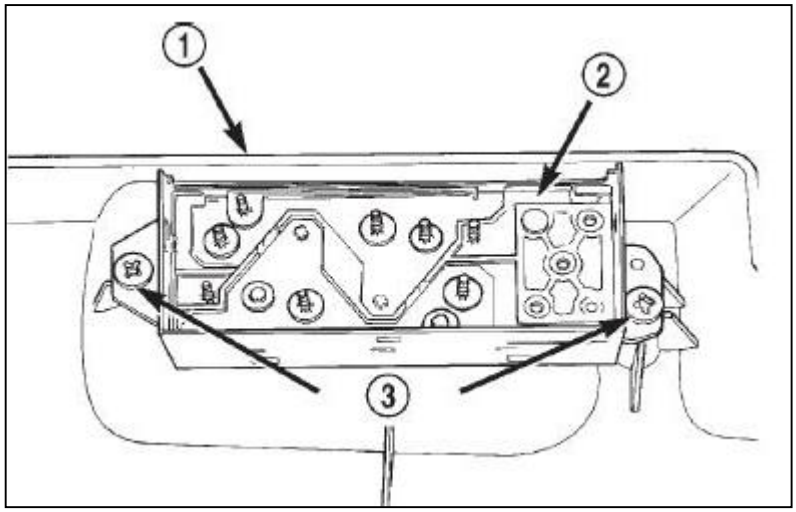


Figure 2.6 : Power seat Switch remove and instal of Jeep XL system

1. Seat side shield
2. Power seat switch
3. Screws

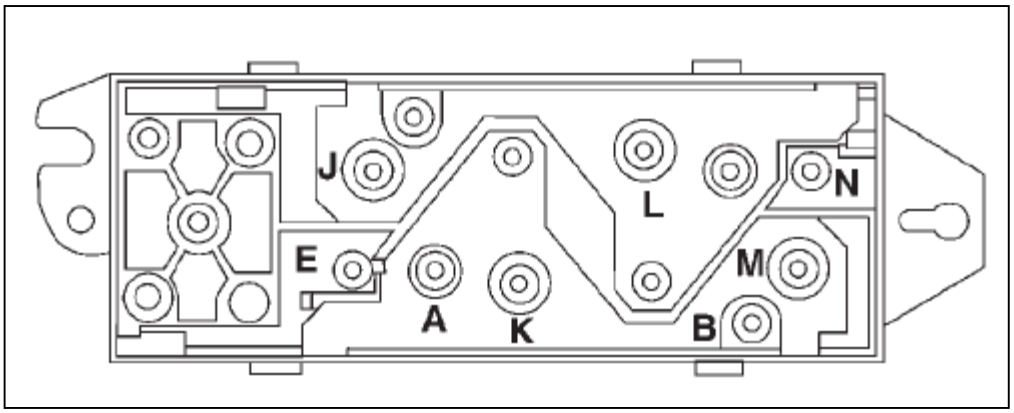


Figure 2.7 : Example of Power seat continuity of Jeep XL sytem

Table 2.2 : Jeep XL continuity Power Seat

Swich Postion	**Left seat switch**	**Right seat switch**
Off	B-E,B-J,B-K,B-L,B-M and B-N	A-E,A-J,A-K,A-L,A-M,A-N
Vertical Up	A-J,A-M,B-E and B-N	A-J,A-N,B-E,B-M
Vertical Down	A-E,A-N,B-Jand B-M	A-E,A-M,B-J.B-N
Horizontal Forward	A-L,B-K	A-L,B-K
Horizontal Rearward	A-K,B-L	A-K,B-L
Front til up	A-M,B-N	A-N,B-M
Front til down	A-N,B-M	A-M,B-N
Real til up	A-J,B-E	A-J,B-E
Real til down	A-E,B-J	A-E,B-J

2.1.3.2 Power Seat Adjuster And Motor

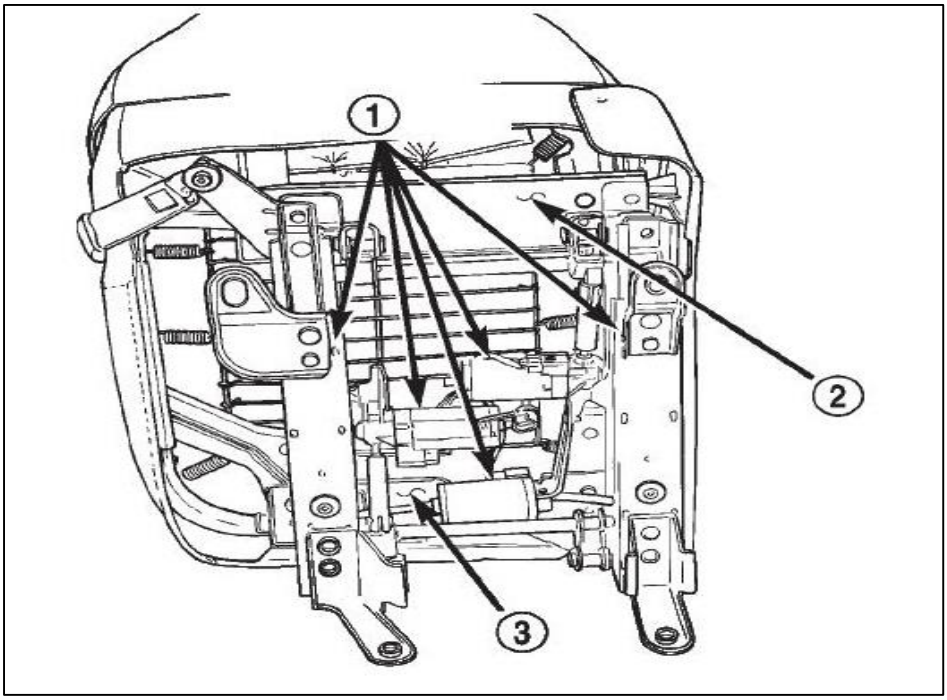


Figure 2.8 :Back position of Power Seat Adjuster and Motor remove/Install

1-Power seat adjuster and Motor

2-Seat Cushion Frame

3-Seat Cushion frame

A motor or motors is assembly control power seat movement. Multiple motor power seat system use integrate gears to move in variety direction.When the position of the seat is set,there are some vehicles have set position memories to allow automatic re-positioning if the seat been moved.This mechanism combined with the electric mirror adjustment concept.

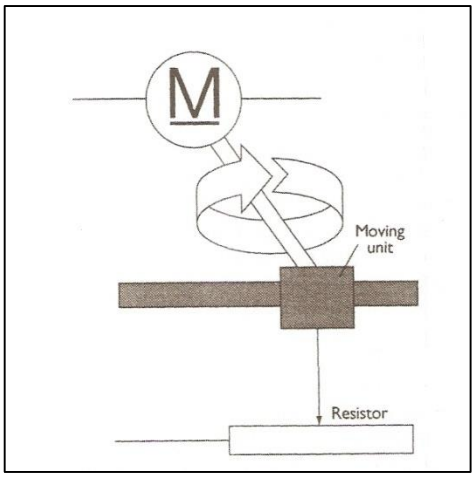


Figure 2.9:Position of memory for electric seat

Figure 2. 9 above show how the circuit designed to allow the position memory.Memory seat return seats to a preprogrammed settings.Most vehicle makers use the same type of operating sytem for memory seat.

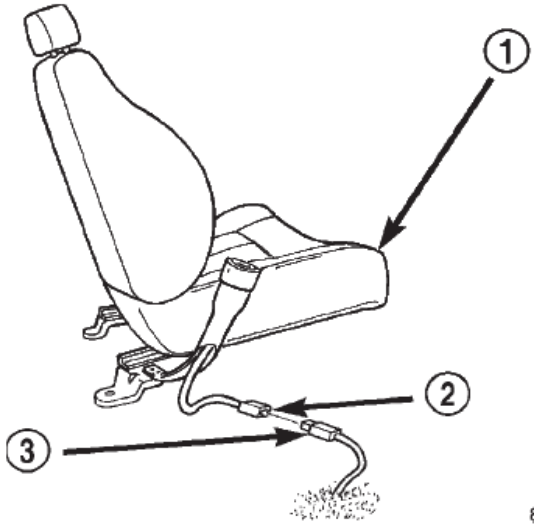
The variable resistor that mechanically constructed to the motor moved as the seat is moved.The value of resistance make feedback to an electronic control unit. This system can be 'remembered' in a number of ways .The resistor is supply with a fixed voltage such that the output relative to the seat position is proportional to seat's position.This voltage can then be 'analogue-to-digital' converted,which produces a simple 'number' to store in digital memory.When the drivers operates the memory recall switch the memory module moves the motor until the feedback voltage of the position equally the feedback voltage store in the computer settingThe memory seat module store the memory positions by recording the feedback voltage of each position sensor .This facility is often isolated when the engine is running prevent the seat moving into the dangerous position as the car is being driven.The position seats can still be adjusted by operating the switches as normal.

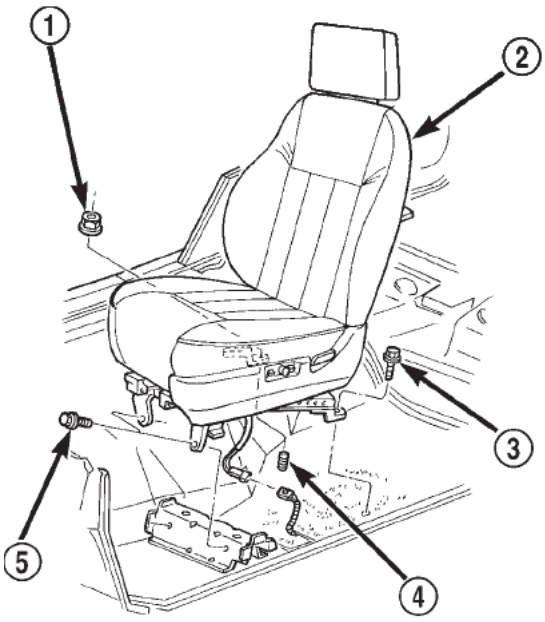
Each motors motor contains a self-ressting circuit breaker to protect it from overload. Consecutive or frequent ressting of the circuit breakers must be allowed and to continue or motor may be damanged . Make necessary to repairs.

2.1.3.3 Circuit Breaker

An automatic restting circuit breaker in the juction block is used to protect the power seat system circuit. The circuit breaker can protect the system from a short circuit or form an overload caondition caused by an obstructed or stuck seat adjuster. The circuit breaker cannot be repaired and if faulty , it must be replaced.

2.1.4 Power Seat Remove And Installation System Diagram And Explanation.

Diagram	Explanation
	Driver Seat Belt swicth connector 1. Driver side Front seat 2. Seat Belt switch connector 3. Body wire Harness Connector



Power seat removel and install

1. Nut
2. Driver side front seat
3. Screw
4. Stud
5. Screw

2.2 PROJECT APPLICATION

In this project I applied the remote control system concept to make the seat mechanism move forward and backward. This chapter will elaborate briefly more about the concept and types of remote control.

2.2.1 Remote Control system

Automatic control system plays a vital role in technology progress of human civilizations. In the early days of civilization, people used levers and linkages to control process, which required energy and power beyond human reach. Now, society tends to rely heavily on automatic control systems for its days-to-days operation.

Automatic washing machine, refrigerators and oven are examples of some of the simpler systems used in home. Aircraft automatic pilots, welding and inspection robots used in manufacturing, electric power generation represent complex control system. Automatic control system is a control system that is self-regulating without any human intervention.

Control system is a group of physical component arranged to control themselves or another system. A control system have consists two part such as subsystems and processes assembled for the purpose of obtaining a desired output with desired performance, given a specified input.

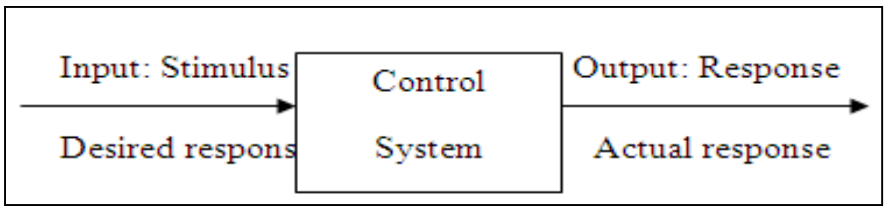


Figure 2.10: Simplified description of a control system.

Nowadays many systems use remote control such as toys for the kids and in daily life works and it is an electronic devices use for the remote operation of a machine. A remote control is an electronic device for the remote operation of a machine. This system saves human operator place-to-place traveling time and protects the operator from dangers in hazardous environments. It makes our life become easier.

One of the earliest examples of remote control was developed in 1898 by Nikola Tesla, and described in his patent, U.S. Patent 613,809 , named *Method of an Apparatus for Controlling Mechanism of Moving Vehicle or Vehicles*.

In 1903, Leonardo Torres Quevedo presented the *Telekino* at the Paris Academy of Science, accompanied by a brief, and making an experimental demonstration. In the same time he obtained a patent in France, Spain, Great Britain, and the United States. The *Telekino* consisted of a robot that executed commands transmitted by electromagnetic waves. It constituted the world's first apparatus for radio control and was a pioneer in the field of remote control. In 1906, in the presence of the king and before a great crowd, Torres successfully demonstrated the invention in the port of Bilbao, guiding a boat from the shore. Later, he would try to apply the *Telekino* to projectiles and torpedoes, but had to abandon the project for lack of financing.

The first remote-controlled model aeroplane flew in 1932, and the use of remote control technology for military purposes was worked intensively during the Second World War, one result of this being the German Wasserfall missile.

By the late 1930s, several radio manufacturers offered remote controls for some of their higher-end models. Most of these were connected to the set being controlled by wires, but the Philco Mystery Control (1939) was a battery-operated low-frequency radio transmitter, thus making it the first wireless remote control for a consumer electronics device.

In the 1980s Steve Wozniak of Apple, started a company named CL 9. The purpose of this company was to create a remote control which could operate multiple electronic devices. The CORE unit as it was named stands for Controller of Remote Equipment was introduced in the fall of 1987. The advantage to this remote controller was that it could "learn" remote signals from other different devices. It also had the ability to perform specific or multiple functions at various times with its built in clock. It was also the first remote control which could be linked to a computer and loaded with updated software code as needed. The CORE unit never made a huge impact of the market. It was much too cumbersome for the average user to program, but it received rave reviews from those who could figure out how to program it. These obstacles eventually lead to the demise of CL 9, but one of its employees continued the business under the name Celadon. This was one of the first computer controlled learning remote controls on the market.

By the early 2000s, the number of consumer electronic devices in most homes greatly increased, along with the number of remotes to control those devices. According to the Consumer Electronics Association, an average American home has four remotes. To operate a home theater as many as five or six remotes may be required, including one for cable or satellite receiver, VCR or digital video recorder, DVD player, TV and audio amplifier. Several of these remotes may need to be used sequentially, but, as there are no

accepted interface guidelines, the process is increasingly cumbersome. Many specialists, including Jakob Nielsen, a renowned usability specialist and Robert Adler, the inventor of the modern remote, note how confusing, unwieldy and frustrating the multiplying remotes have become.

2.3. HOW DO REMOTE CONTROL WORK

Generally, there are two types of remote controls: infrared (IR), and radio frequency (RF). Infrared remote controls work by sending pulses of infrared light to a device, while RF remote controls use radio waves in much the same way. Pragmatically, the biggest difference between the two is range. IR remote controls require a clear line of sight to the receiving device and their range maxes out at about 30 feet or 9.14 meters. RF remote controls can go through walls and around corners, with a range of roughly 100 feet or 30.48 meters.

2.3.1 Infrared Remote Control

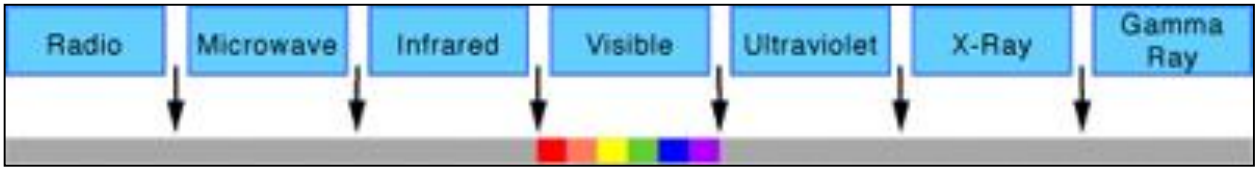


Figure 2.11: Remote control light spectrum for IR remote.

The dominant remote-control technology in home-theater applications is infrared (IR). Infrared light is also known as plain-old "heat." The basic premise at work in an IR remote control is the use of light to carry signals between a remote control and the device it's directing. Infrared light is in the invisible portion of the electromagnetic spectrum An IR remote control such the transmitter sends out pulses of infrared light

that represent specific binary codes. These binary codes correspond to commands, such as Power On/Off and Volume Up. The IR receiver in the TV, stereo or other device decodes the pulses of light into the binary data likes ones and zeroes that the device's microprocessor can understand. The microprocessor then carries out the corresponding command.

2.3.2 Radio Remote Control

This transmitter is designed to send out radio waves to a receiver, which consists of a circuit board and antenna houses inside the toy. Once the transmitter is pressed to send the signal, the toy's motor becomes activated, followed by some type of action being taken, the car moving, the animal barking, the robot walking around, and so on.

The way the radio remote control works is that once the signal has been sent and received, the motor can then go into operation. The power source for items such as these would depend on how the toy was made but typically, it would be some type of battery or battery pack. Additionally, there are some radio remote control toys that have guidance whereas others work off locomotion. The greatest advantage to radio-frequency remotes is their range: They can transmit up to 100 feet from the receiver, the range for Bluetooth is shorter and radio signals can go through walls.

CHAPTER 3

METHODOLOGY

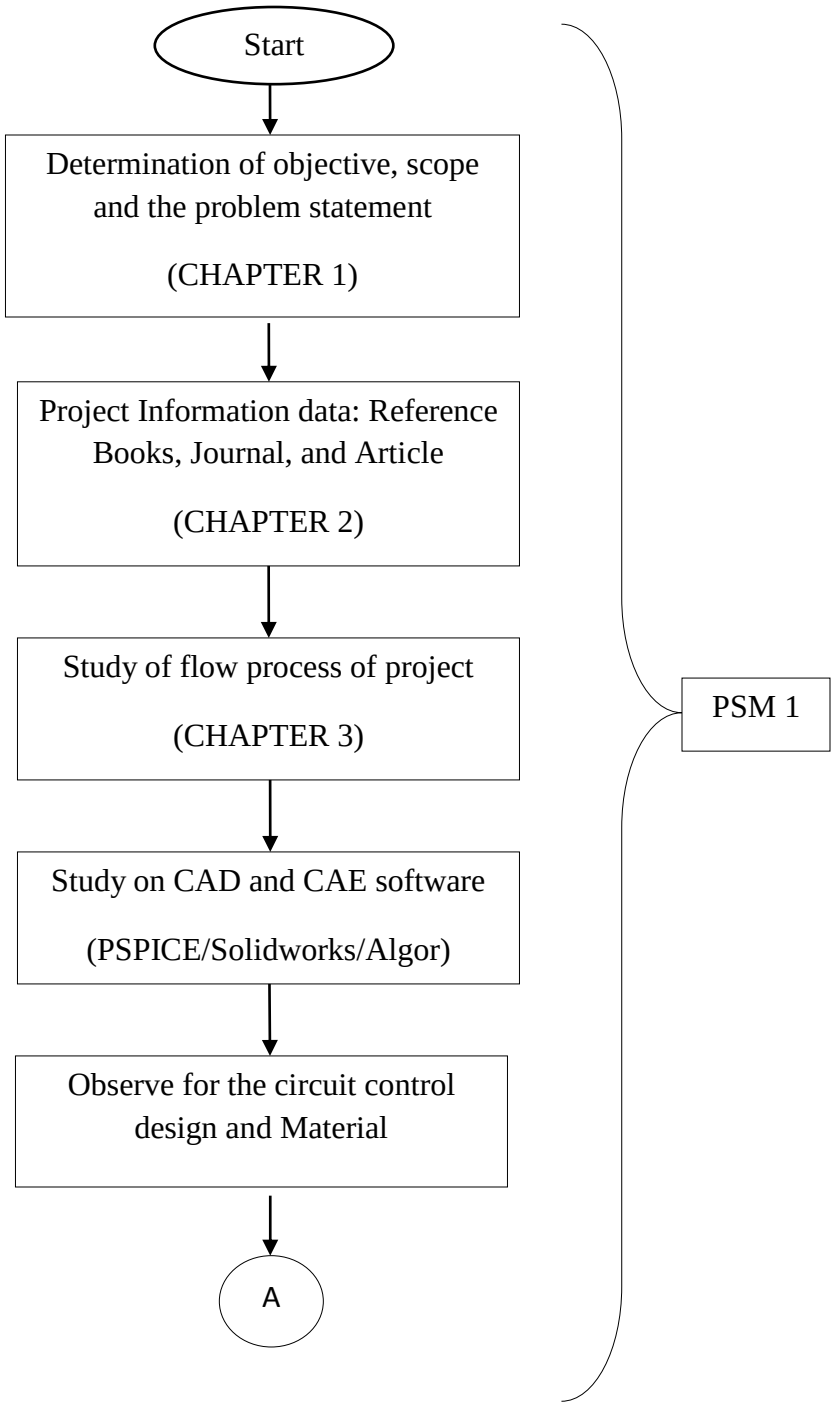
In this chapter I would elaborate details the flow process of my project for the whole one year. Besides that I include all the method and material use in project in this chapter. Step by step method will show in this chapter.

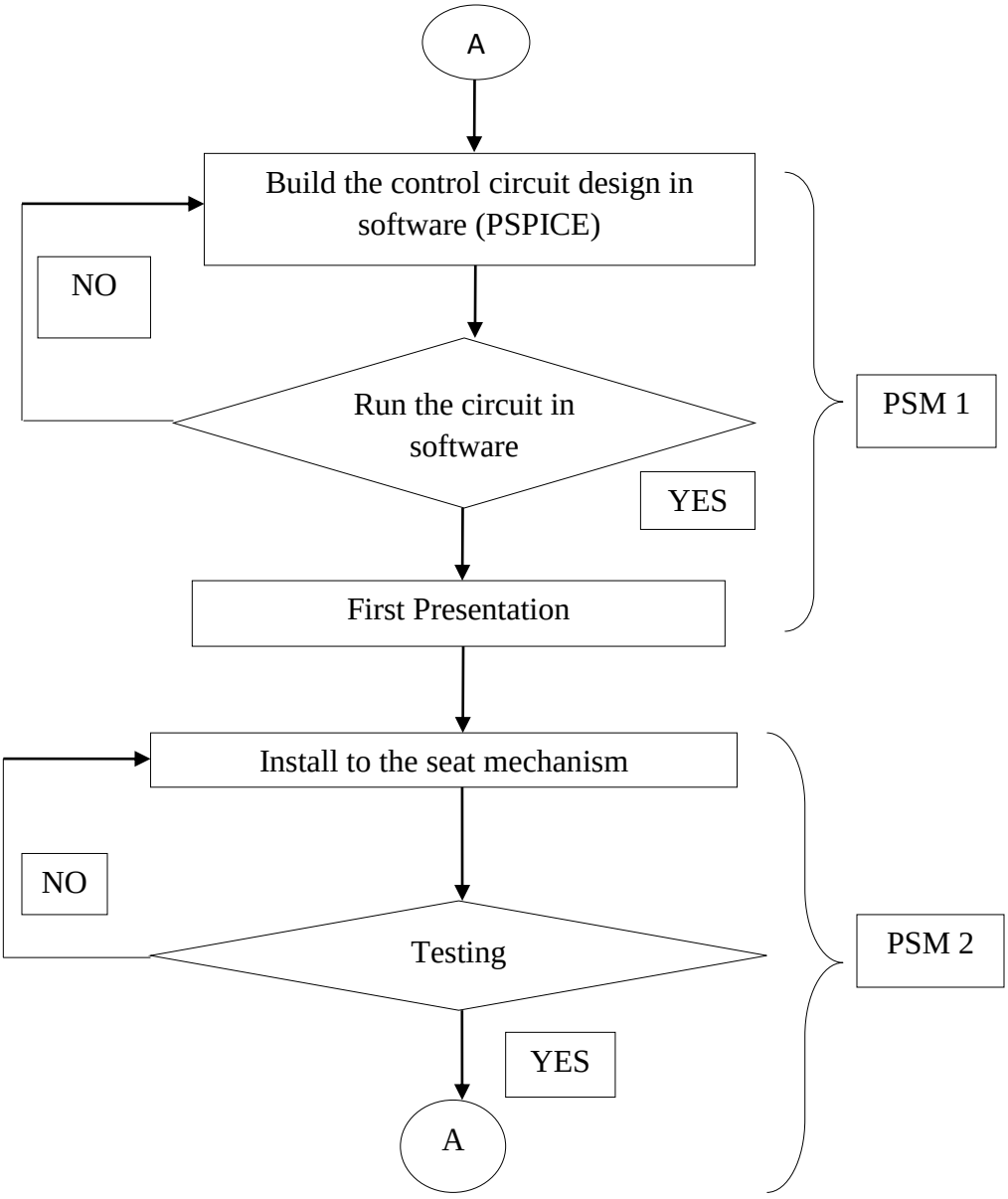
3.1 FLOW CHART FOR THE WORK PROCESS THROUGH THE PROJECT

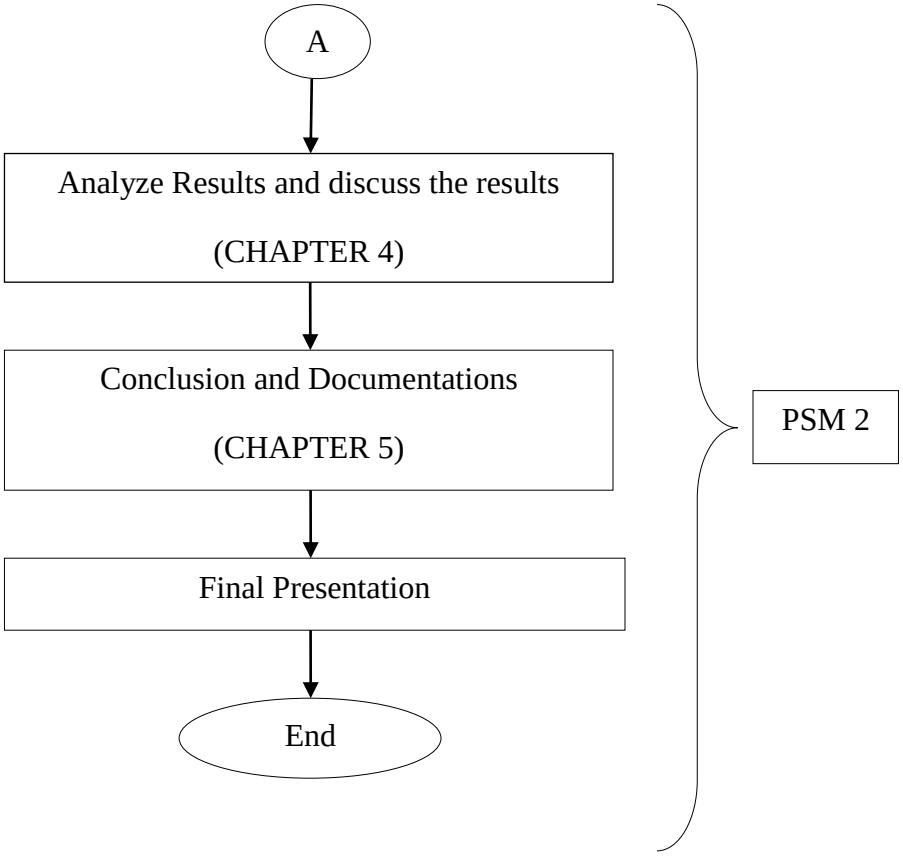
My project begin with determination of objective of project, statement of problem, scope of project that included in chapter one. After finish done the chapter one, I continue search for information from the books, journals or other avowed source that related to my project. In the same time, I study the flow process of my project's methodology, how my project will run properly step by step.

Then I continue with study of the software that will be use in this project such as PSPICE and Visual Basic. The function of PSPICE software is design a schematic diagram of control circuit and also it can run the circuit design. Besides that, Visual Basic is software to program the data in microcontroller. I also observe for control circuit design and the materials such as the electronic components.

After done the circuit design, I continue build it in PSPICE software and write the code program for microcontroller in Visual Basic. After finish that stage I will run the circuit, if my design circuit cannot run smoothly I will repeat again the previous stage with a new circuit design until it success to run properly I continue the next step which is fabricate the circuit and install the circuit to the seat mechanism. After finish installation process, I test my circuit whether it successfully can control the movement of driver's seat or not, if something inside my circuit such as breakdown of electronic component during testing process I will repeat fabricate the circuit. After the testing process, I will analyze and discuss the problem occur in my control circuit design in chapter 4 and chapter 5.


Start
Determination of objective, scope and the problem statement
(CHAPTER 1)
Project Information data: Reference Books, Journal, and Article
(CHAPTER 2)
Study of flow process of project
(CHAPTER 3)
Study on CAD and CAE software
(PSPICE/Solidworks/Algor)
Observe for the circuit control design and Material
A
PSM 1

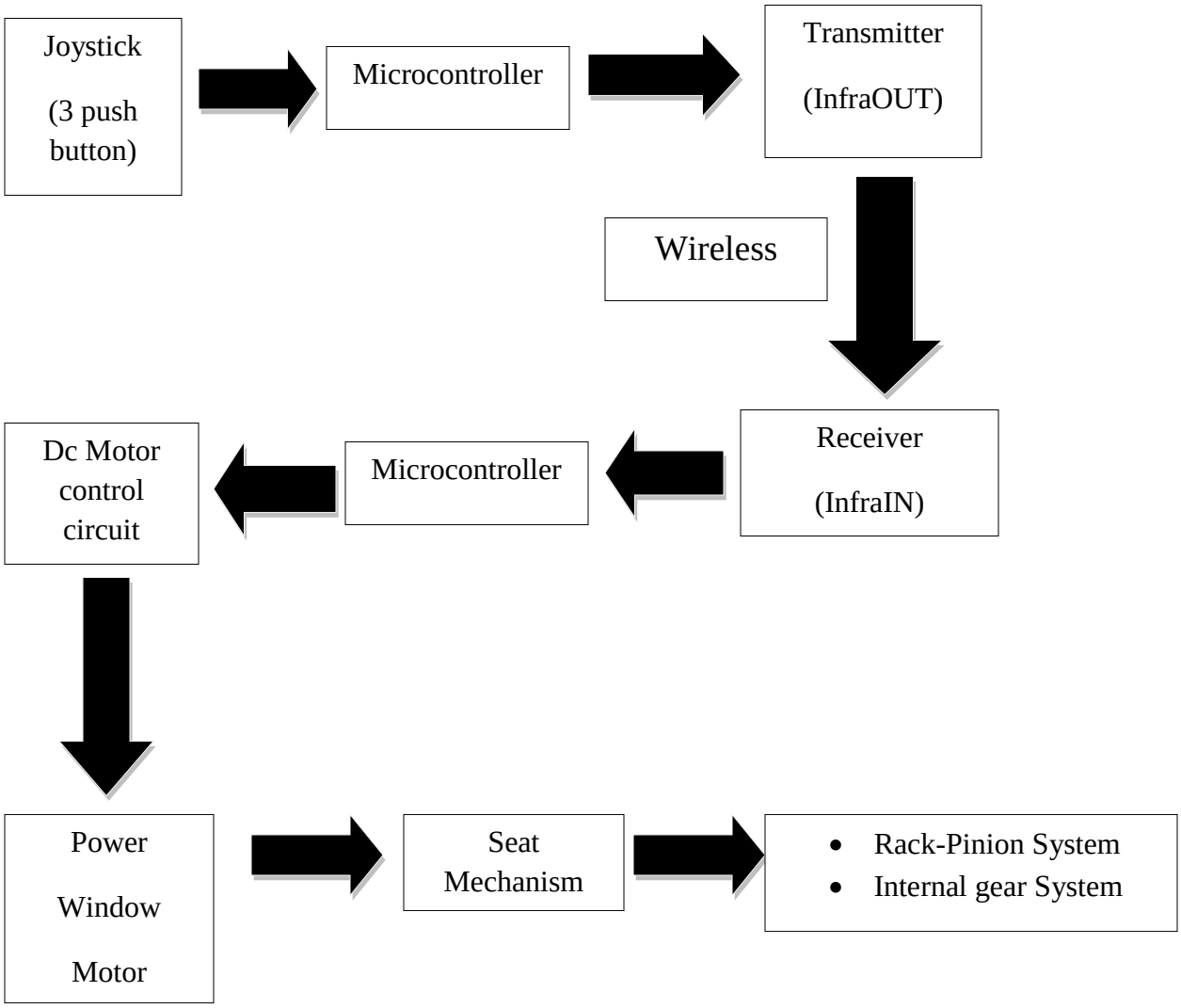

A
Build the control circuit design in software (PSPICE)
NO
Run the circuit in software
YES
PSM 1
First Presentation
Install to the seat mechanism
NO
Testing
YES
A
PSM 2


A
Analyze Results and discuss the results
(CHAPTER 4)
Conclusion and Documentations
(CHAPTER 5)
Final Presentation
End
PSM 2

3.2. BLOCK DIAGRAM OF THE WHOLE SYSTEM OF ANTI THEFT CARSEAT DESIGN

In this subtopic I briefly explain my preliminary design of control circuit that will adapt to the seat mechanism.

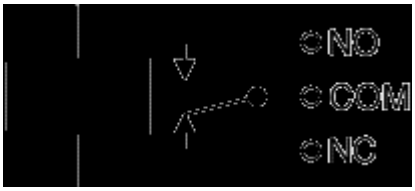
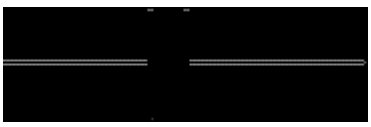
3.2.1 Block Diagram of The Control Circuit Description



The diagram above shows briefly about the block diagram of my control circuit that will control the movement of the seat forward and back ward. The User starts to control the circuit by push one of the two push button switches at the transmitter. This circuit has three push button switches which is the first button for ‘forward’ and second for ‘backward’ and the third for ‘stop’. When user pushes the switches button, microcontroller will process the data input and will produce an infra data, then the Infrared transmitter circuit send data to the receiver circuit through LED via wireless.

The Infrared receiver receives the data and again microcontroller in receiver circuit will process the data input then it wills active a dc control circuit. One of the relay switches at dc circuit will active and make the motor to rotate. The bidirectional rotating of motor depends on types of data accepted. The movement of motor will control the movement of the driver seat whether forward or backward.

3.3 ELECTRONICS CIRCUIT SYMBOLS AND FUNCTIONS EXPLANATION.

Component	Circuit symbol	Function of component
Wire		To pass current very easily from one part of a circuit to another.
Wires joined		A 'blob' should be drawn where wires are connected (joined), but it is sometimes omitted. Wires connected at 'crossroads' should be staggered slightly to form two T-junctions, as shown on the right
Push Switch (push-to-make)		A push switch allows current to flow only when the button is pressed
Relay		An electrically operated switch, for example a 9V battery circuit connected to the coil can switch a 230V AC mains circuit. NO = Normally Open, COM = Common, NC = Normally Closed
Resistor		A resistor restricts the flow of current, for example to limit the current passing through an LED. A resistor is used with a capacitor in a timing circuit
Capacitor		A capacitor stores electric charge. A capacitor is used with a resistor in a timing circuit. It can also be used as a filter, to block DC signals but pass AC signals

Capacitor, polarized		A capacitor stores electric charge. This type must be connected the correct way round. A capacitor is used with a resistor in a timing circuit. It can also be used as a filter, to block DC signals but pass AC signals
Diode		A device which only allows current to flow in one direction
LED Light Emitting Diode		A transducer which converts electrical energy to light
Transistor NPN		A transistor amplifies current. It can be used with other components to make an amplifier or switching circuit
Transistor PNP		A transistor amplifies current. It can be used with other components to make an amplifier or switching circuit
Motor		A transducer which convert electrical energy to kinetic energy (motion)

CHAPTER 4

RESULTS AND DISCUSSION

The purpose of this chapter is to provide and elaborate all the result obtained from this project included the control system and the gearing system.

4.1 MICROCONTROLLER

In this project I have chosen microcontroller PICAXE14M type because of suitability with the control system that I do. The PICAXE is an easy–to-program microcontroller system that exploits the unique characteristics of the new generation of low-cost ‘FLASH’ memory based microcontroller. PICAXE microcontroller can be programmed over and over again without the need for an expensive programmer. The power of the PICAXE system is its simplicity. No programmer, eraser or complicated electronic system required. PICAXE also can be programmed in a graphical 'flow-chart' environment or in easy to understand BASIC.

4.2 Description and Operation

The PICAXE-14M is considered a step-up from the bare-bones entry-level 08 series. It offers twice the program memory, interrupts, and pulse-width modulation. It is also good for motor controllers system and very suit with my control system. The

PICAXE-14M microcontroller provides 5 input and 6 output pins. The coding inside this PICAXE14M that I have done installed is from the visual Basic.

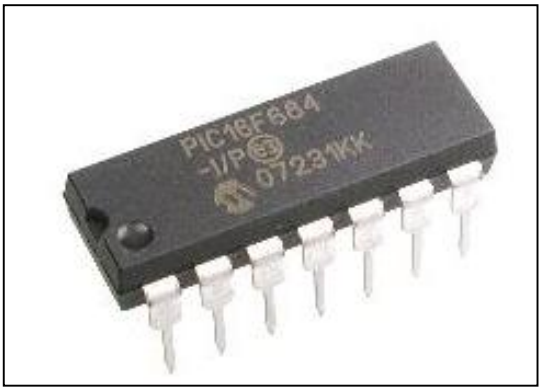


Figure 4.1: PICAXE14M microcontroller

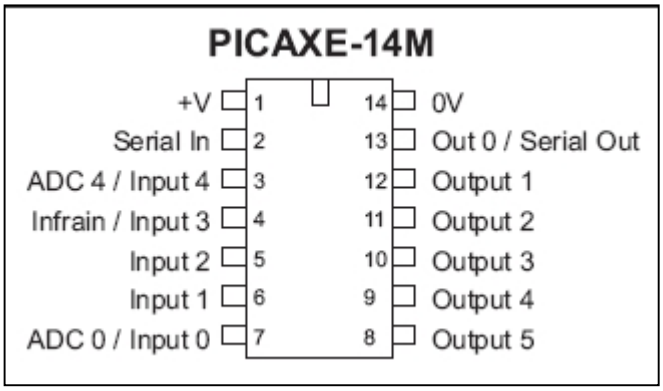


Figure 4.2: PICAXE14M:PICAXE14M circuit symbol

4.3 INFRARED TRANSMITTER CIRCUIT

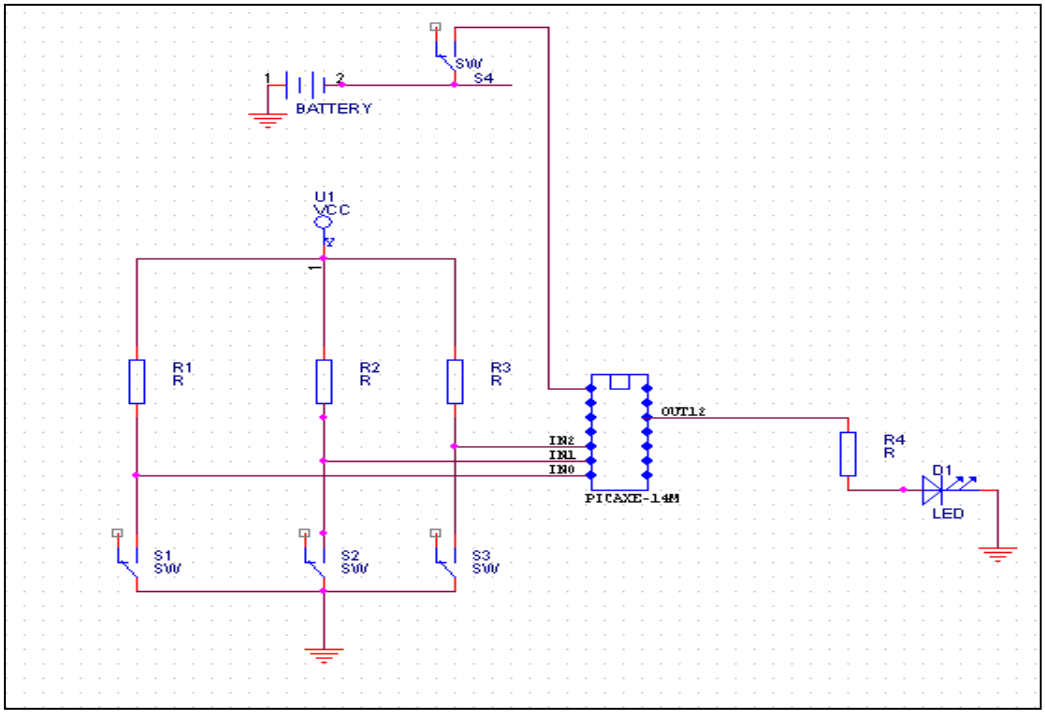


Figure 4.3: Infrared Transmitter Circuit.

4.3.1 Usage of Transmitter

In this circuit contain 3 push button which are ‘forward’ button , ‘reverse’ button and also ‘stop’ button ,when user pressing the first button that is button ‘forward’ it would make microcontroller analyze the data and send data '0' to receiver circuit through Infrared. If user presses the second button that is ‘reverse’ button, Microcontroller will analyze the data and send data'1' to receiver circuit and lastly same subject matter will happen to this system, data’2’ will be sent to receiver circuit if third button is press. Data ‘0’ and data ‘1’ is the data will make the 12volt Motor move bidirectional.

4.3.2 Transmitter Operation

If we press S1 switch, the current will allow current through the wire. In this circuit the resistor position parallel to each other and same with the other two switches; S2 and S3 because of resistor will restrict the current flow and make the amount of current flow same among the tree switches. The value of each resistor is 10K[illegible]. The first resistor connects to pin IN0, the second Resistor connects to pin IN1 and the last Resistor connects to the pin IN2 at the PICAXE14M Microcontroller. I used 3AA types of Battery to supply the electrical energy to the transmitter circuit. The S4 switch is the switch that active the transmitter circuit. The fourth Resistor is connects with the LEDs in the series way. LEDs is the short form from Light Emitted Diodes, LEDs is a transducer which convert electrical energy to the light. LEDs must be connected the correct way round, because of the leads are labeled '+' for anode and '-' for cathode.

4.4 INFRARED RECEIVER CIRCUIT

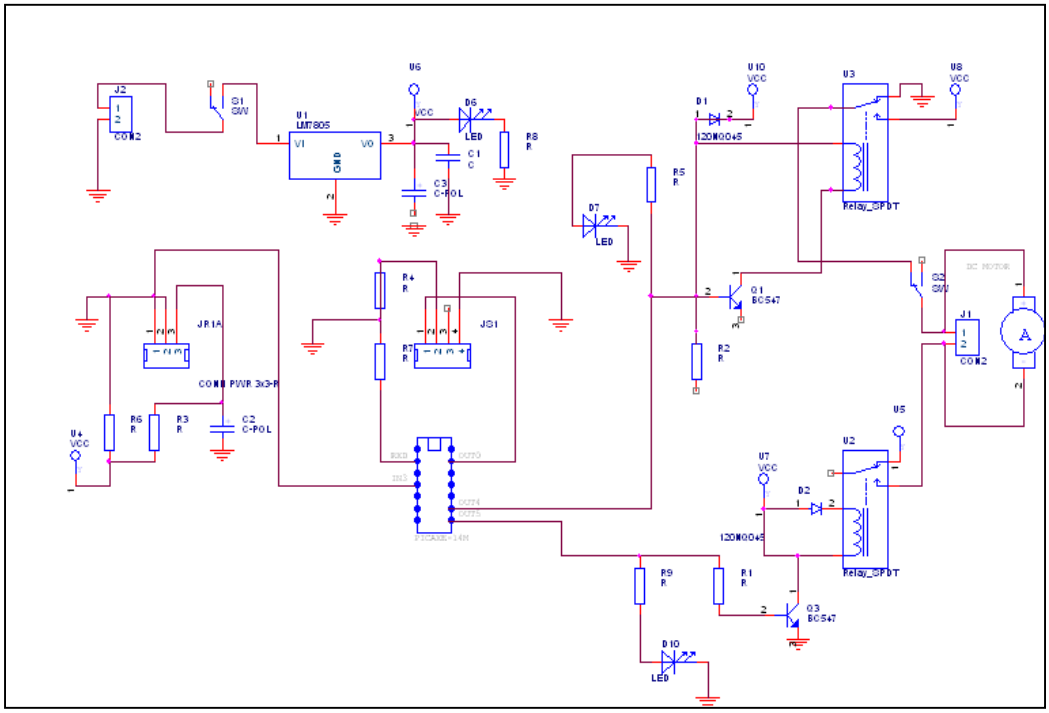


Figure 4.4: Infrared Receiver Circuit.

4.4.1 Usage of Receiver Circuit

In this circuit have 2 relays. A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be 'ON' or 'OFF' so relays have two switch positions and they are double throw switches, the coil of a relay passes a relatively large current, typically 30mA for a 12Volt relay like in this circuit. The switches connect with the relay are NPN transistor and a usual switch.NPN transistor is used in other component to make an amplifier transistor or switching circuit. The leads of NPN transistor are labeled base (B), collector (C) and emitter (E).

4.4.2. Receiver Operation

If we press S1 switch at the transmitter circuit, the first relay that connects with the pin OUT4 at the PICAXE14M will active .The first relay will make the 12volt DC motor turn the forward motion and if we press S2 switch at the transmitter circuit, the second relay that connects with the pin OUT5 at the PICAXE14M will active and no active the first relay. The Second relay will make the 12volt DC motor turn opposite position; it will reverse the motion of the DC motor.

4.4.3 The advantages of relays

There has several advantages used the relay in the receiver circuit.

1. Relays can switch AC and DC, transistors can only switch DC.
2. Relays can switch high voltages, transistors cannot.
3. Relays are a better choice for switching large currents (> 5A).
4. Relays can switch many contacts at once.

4.5 MOTOR SPECIFICATION

In my Infrared Receiver Circuit I only used 12 Volt DC Motor but in the real project it will use the 12Volt Power Window Motor. Below is the specification of power window motor:

- Voltage:12.06V
- Stall Torque:0.08Nm
- Minimum Speed:42.3Rpm@4.43rev/min
- Minimum Current:1.41A
- Maximum Current:19.57A
- Maximum Torque:18.88Nm
- Maximum Speed:64.4Rpm@6.74rev/min)
- Power:25.35Watt

4.6 THE DIFFERENT BETWEEN THE PROTOTYPE COMPONENTS WITH THE REAL COMPONENT

Prototype component	Real component	Explanation
		In my prototype circuit I used 12 volt DC motor but the real component of this project is the 12 volt Power Window Motor is use. The infrared remote control prototype circuit can support this motor.
		In my prototype circuit I used 9 volt of battery but the real component of this project is the car's battery. The infrared remote control prototype circuit also can support the car battery.

Table4.1: The Different between the prototype and the real component.

. The Infrared receiver circuit in the real project is connects with the car's battery. If someone wants to move the Driver seat, he or she must have a car key to activate the Infrared receiver circuit and move the position of the Driver Seat. This works become complicated to the thief if they want to steal the car.

4.7 THE INFRARED REMOTE CONTROL PROTOTYPE CIRCUIT.

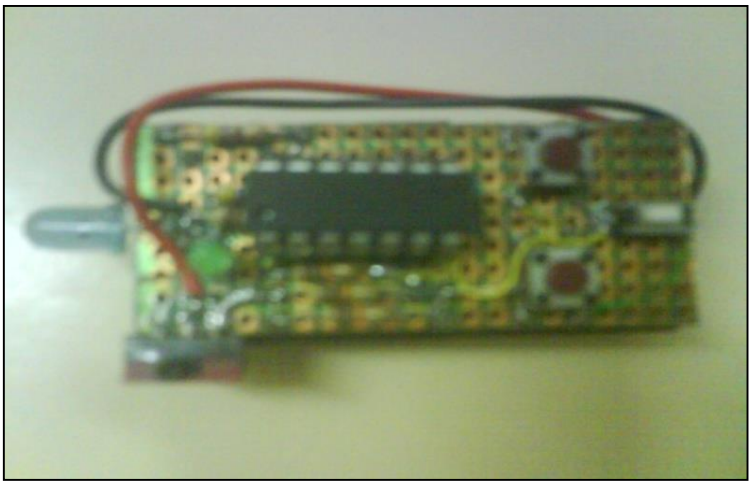


Figure 4.5: The prototype of Infrared Transmitter Circuit

Figure 4.6: The prototype of Infrared Receiver Circuit

4.8 THE GEARING SYSTEM

In this project involved of the gearing system that directly connect with the 12 volt DC motor and I have choose the spur gear. The spur gear is the common type of gear. The spur gear is used to transmit the motion between parallel shafts or between a shaft and rack. The teeth of spur gear are radial, uniformly spaced around the outer periphery and parallel to the shaft which the gear is mounted. Contact between the mating teeth of spur gear is in a straight line parallel to the rotational axis. Sometimes, many spur gears are used at once to create very large gear reductions.

4.8.1. Rack And Pinion System

Rack and pinion gears are used to convert rotation into linear motion. A perfect example of this is the steering system on many cars. The steering wheel rotates a gear which engages the rack. As the gear turns, it slides the rack either to the right or left, depending on which way you turn the wheel but in this project rack and pinion system is used the make the driver car seat move forward and backward like the figure below and it is also replaced the current mechanism at the bottom beam side.

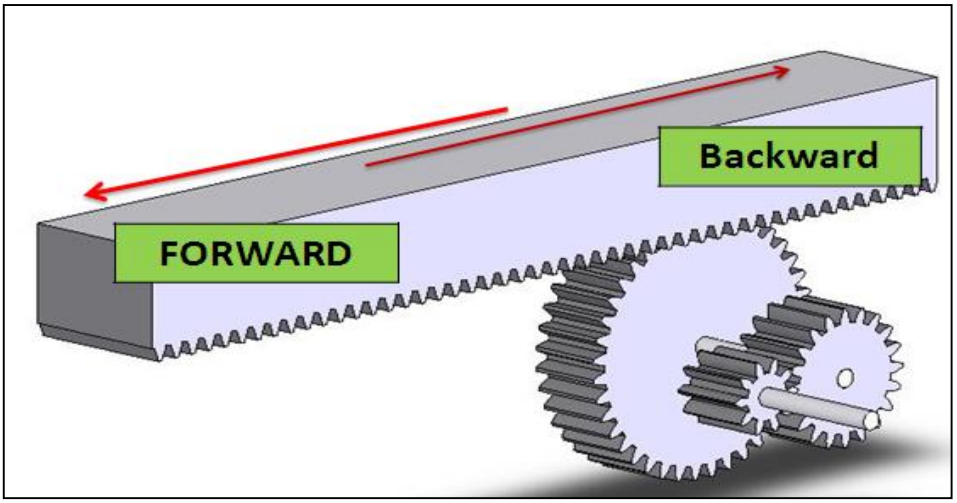


Figure 4.7: Rack and Pinion system

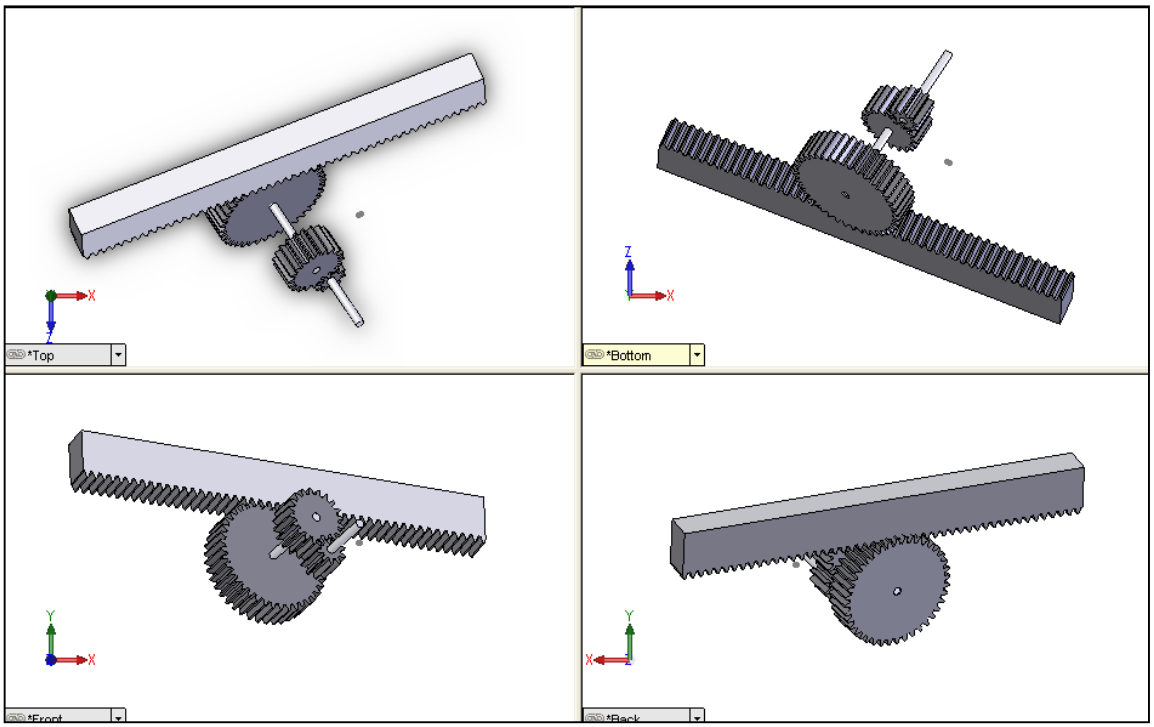


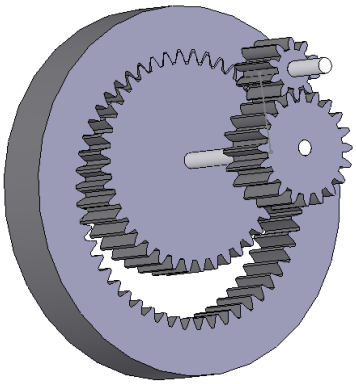
Figure 4.8: Rack and pinion system in the Solidwork view.

The figure 4.8 shows the rack and pinion system in the four views that I do with the Solidworks software. I have chosen the 10 teeth, 20 teeth and also the 40 teeth in this gearing system. The 10 teeth of spur gear are directly connected to the DC motor and the 20 teeth of spur gear are connecting with the 40 teeth spur gear in the couple way. The 20 teeth are placed besides of 10 teeth of spur gear to make the gear reductions.

4.8.2 The Internal Gear System

The internal gear system I used to make the driver car seat backrest bend upward and backward. For the internal gear I have chosen the 50 teeth and the other profile of spur gear is same with the rack and pinion system.

Table 4.1: The different between the current mechanism and the new mechanism

The current Mechanism	The new Mechanism
	

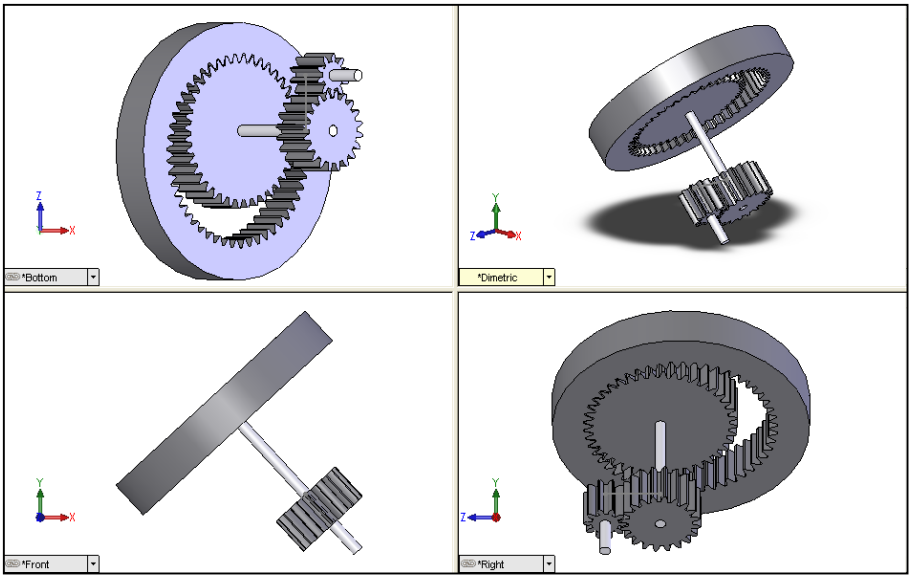


Figure 4.9: The Backrest car seat Driver's new mechanism

4.9. DETAILS ON THE GEARING SYSTEM PROFILES

This topic will elaborate about the gearing profile that involved in my project.

4.9.1 Details on 10 Teeth of Spur Gear Profiles

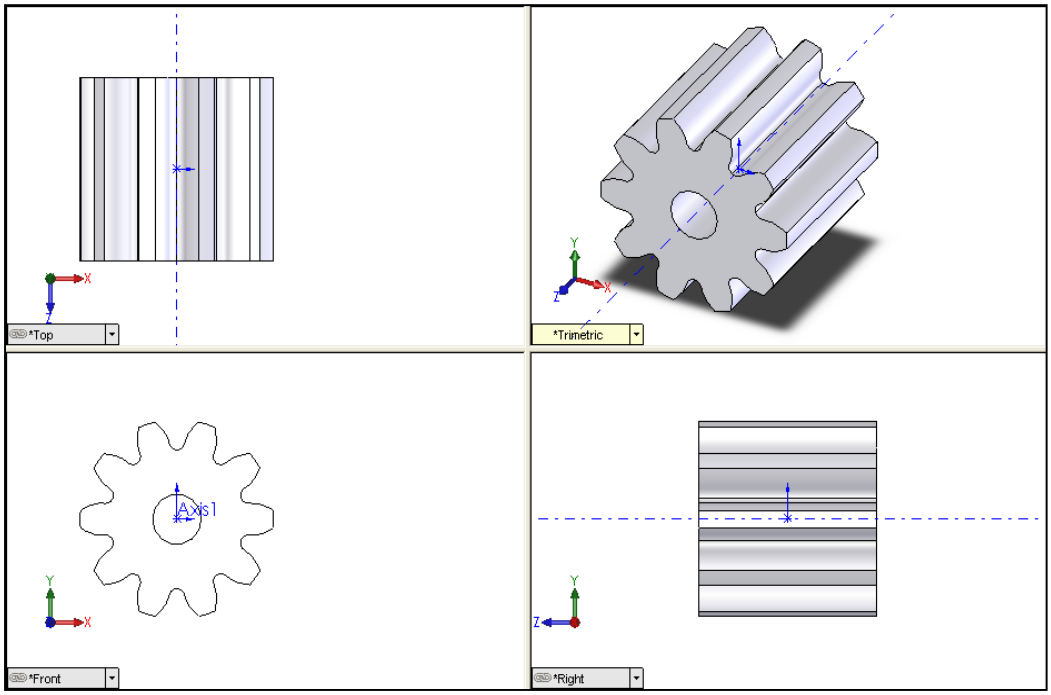


Figure 4.10: The 10 teeth of spur gear in four views of Solidworks

Table 4.2: 10 teeth of spur gear Properties for 1mm module

Items	Value
Pitch Diameter	10.0000mm
Major Diameter	11.1964mm
Minor Diameter	8.2634mm
Addendum	0.9582mm
Dedendum	0.8683mm
Addendum mod. coefficient	0.4819
Addendum mod	0.4617mm
Pressure angle	20.00degree
Base Diameter	9.3969mm
Whole depth	1.8265mm
Circular pitch	3.1416mm
Fillet radius	0.4303mm
Backlash	0.0000mm
Tooth thickness	1.9069mm
Face radius	11.0000mm

4.9.2 Details on 20 Teeth of Spur Gear Profiles

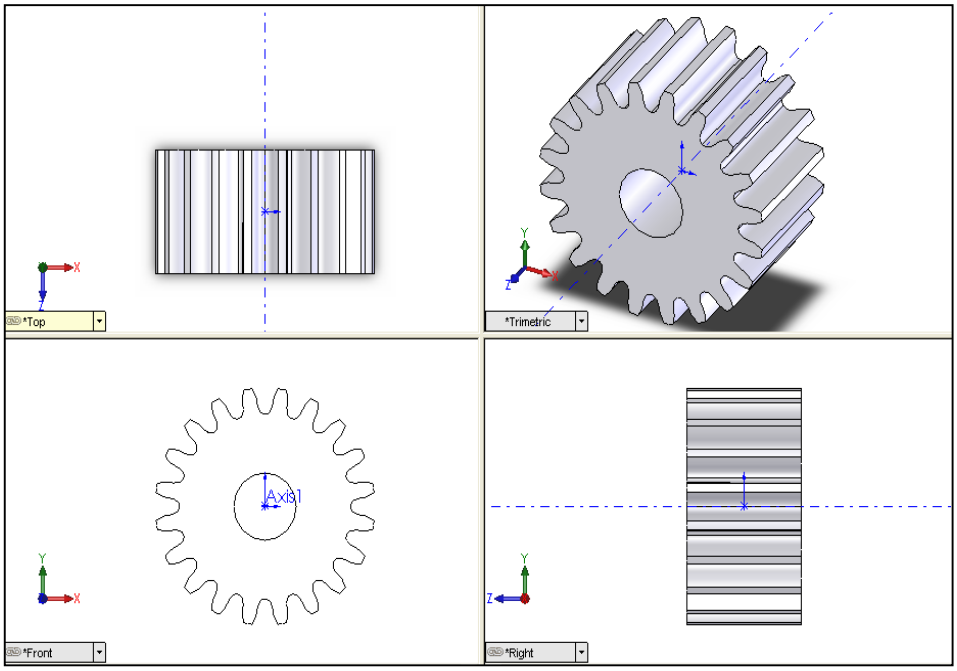


Figure 4.11: The 20 teeth of spur gear in four views of Solidworks

Table 4.3: 20 teeth of spur gear Properties for 1mm module

Items	**Value**
Pitch Diameter	20.0000mm
Major Diameter	21.0766mm
Minor Diameter	16.4166mm
Addendum	0.5383mm
Dedendum	1.7917mm
Addendum mod. coefficient	-0.4819
Addendum mod	-0.4617mm
Pressure angle	20.00degree
Base Diameter	18.7939mm
Whole depth	2.3300mm
Circular pitch	3.1416mm
Fillet radius	0.4303mm
Backlash	0.0000mm
Tooth thickness	1.2347mm
Face radius	11.00mm

4.9.3 Details on 40 Teeth of Spur Gear Profiles

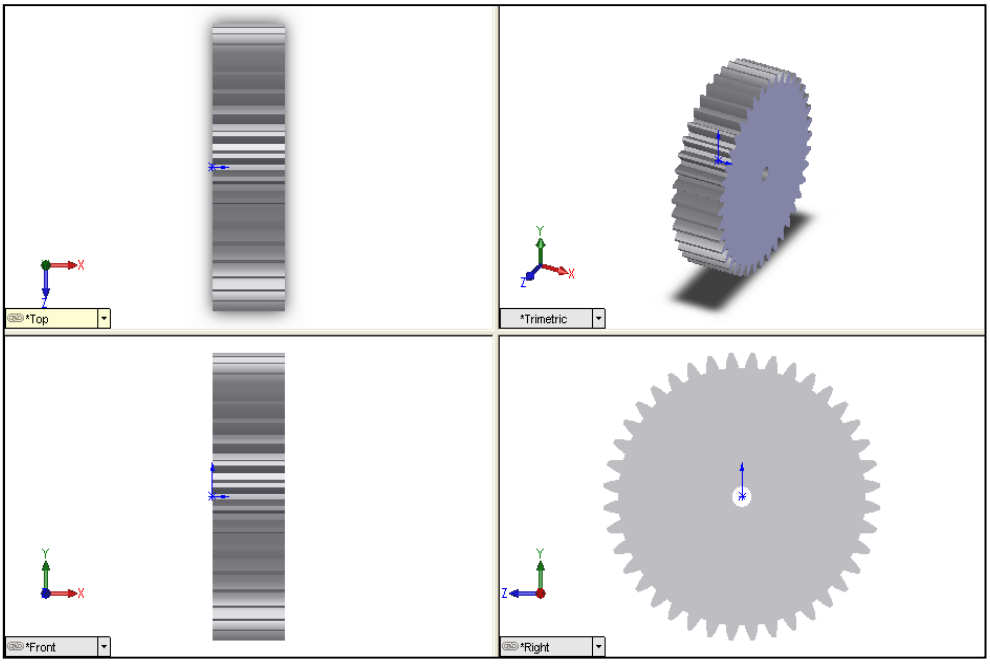


Figure 4.12: The 40 teeth of spur gear in four views of Solidworks

Table 4.4: 40 teeth of spur gear Properties for 1mm module

Items	**Value**
Pitch Diameter	40.0000mm
Major Diameter	42.0000mm
Minor Diameter	37.3400mm
Addendum	1.0000mm
Dedendum	1.3300mm
Addendum mod. coefficient	0.0000
Addendum mod	0.0000mm
Pressure angle	20.00degree
Base Diameter	37.5877mm
Whole depth	2.3300mm
Circular pitch	3.1416mm
Fillet radius	0.4303mm
Backlash	0.0000mm
Tooth thickness	1.5708mm
Face radius	11.0000mm

4.9.4 Details on Rack Spur Gear Profiles

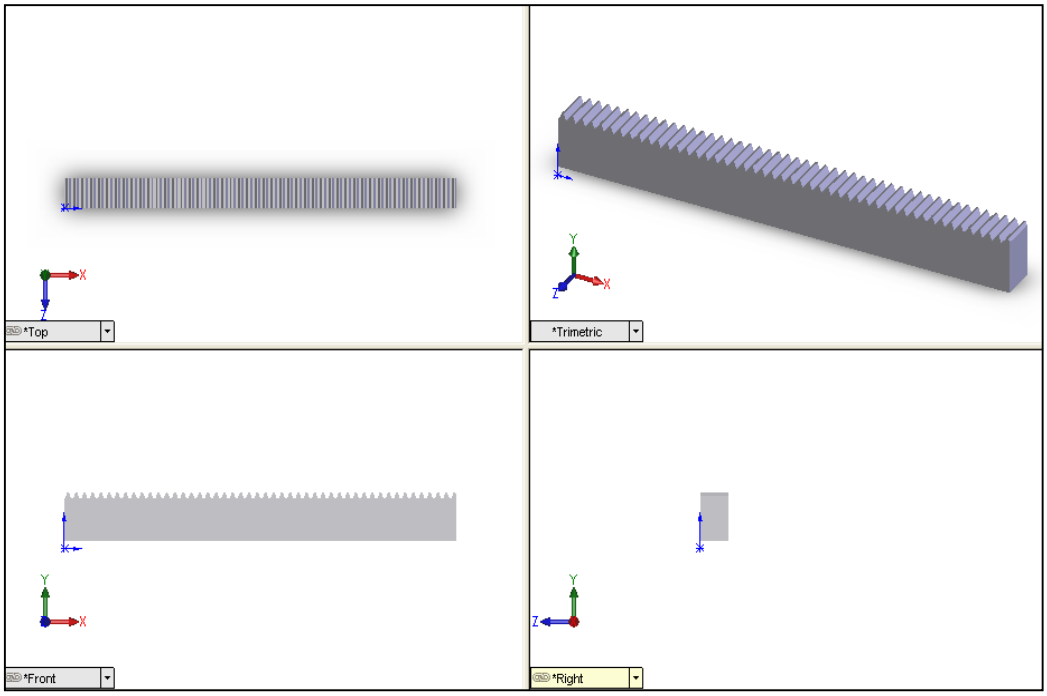


Figure 4.13: The rack of spur gear in four views of Solidworks

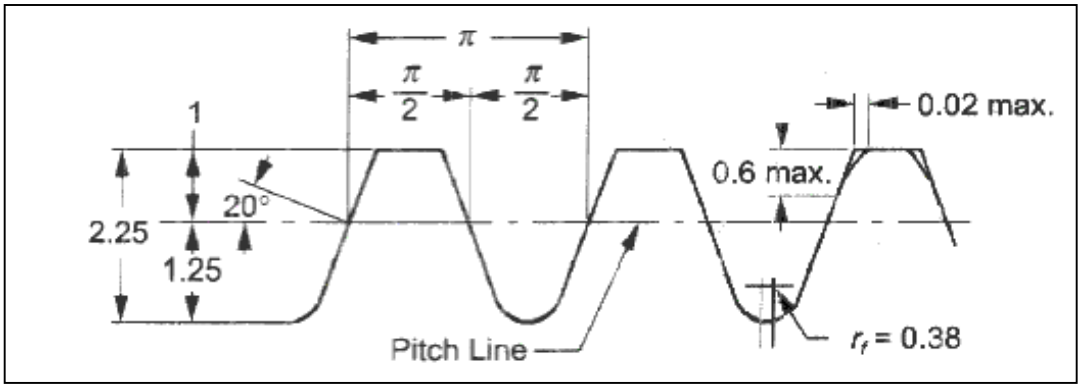


Figure 4.14: Rack of spur gear Properties for 1mm module

4.9.5 Details on 50 Teeth Internal Gear Profiles

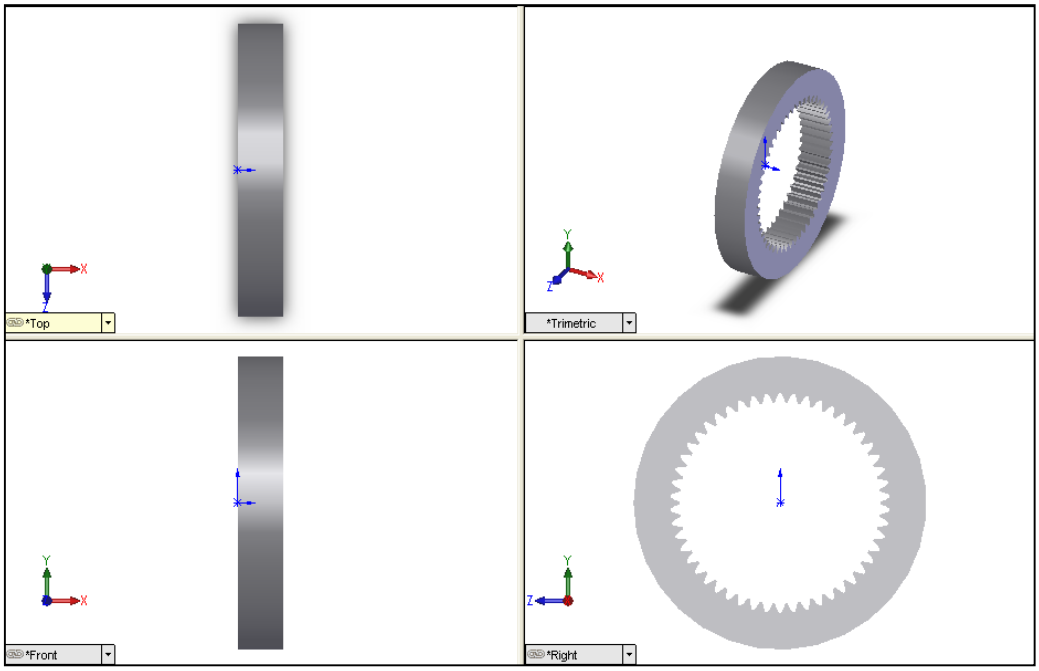


Figure 4.15: The 50 teeth of internal gear in four views of Solidworks

4.9.6 Advantages and Disadvantages of Internal Gear

Advantages:

1. Geometry ideal for epicyclical gear design
2. Allows compact design since the center distance is less than for external gears.
3. A high contact ratio is possible.
4. Good surface endurance due to a convex profile surface working against a concave surface.

Disadvantages:

1. Housing and bearing supports are more complicated, because the external gear nests within the internal gear.
2. Low ratios are unsuitable and in many cases impossible because of interferences.

3. Fabrication is limited to the shaper generating process, and usually special tooling is required.

4.10 CALCULATION PART OF THE GEARING SYSTEM

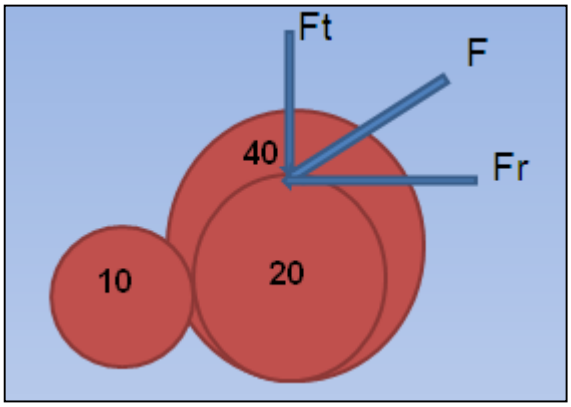


Figure 4.16: The force reacts with the gearing system

F=average maximum weight of Malaysian + the seat weight

=(80kg+30Kg)x9.81N

=1051.52N

Speed pinion=speed motor

42.3rpmx2Π/60=4.43 rad/s

Gear ratio=1:2

So speed gear is= (4.43rad/s)/2=2.215rad/s

Torque motor=torque pinion

Gear ratio=1:2

Torque motor=18.88Nm

So Torque gear=18.88x2=37.76Nm

V=Πdn=Π(11.9164mmx4.43rad/s)

=165.84mm/s→ Pitch line Velocity

H=Tω=(18.88Nmx4.4.3rad/s)

=83.6384Watt→Horse Power

Wt=60 000H/ΠIdn = (60 000x83.6384)/165.84

=30.26KN→Transmitted load that motor provide.

d/2=(21.0766E-3)/2=0.010535m

Wt=Ft=Fcos 20^0=1051.52XCOS 20 ^{0}=988.39N

→Transmitted load required< load that motor provide

*20°=α=pressure angle

T=d/2Wt=(0.010535)x(988.39)=10.412Nm

→Torque that required<Torque motor provide

So that the value of torque and transmitted load can support the seat and also can make it move forward and backward and bend the backrest.

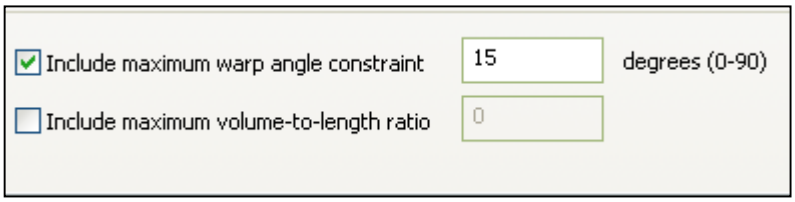
4.11 ANALYSIS BY ALGOR VERSION 22

I have analysis if the torque provide by the motor will affect the stress of the 10teeth and also the 20 teeth of spur gear that involved in this gearing system. The contact is the surface contact that will define between the pinion and the main gear

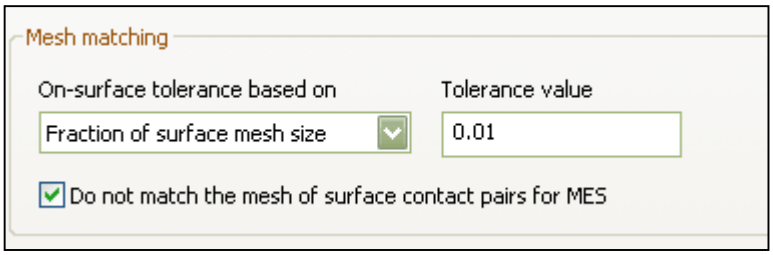
4.11.1The Steps Of Analysis Algor Version 22

1. Model Mesh Setting

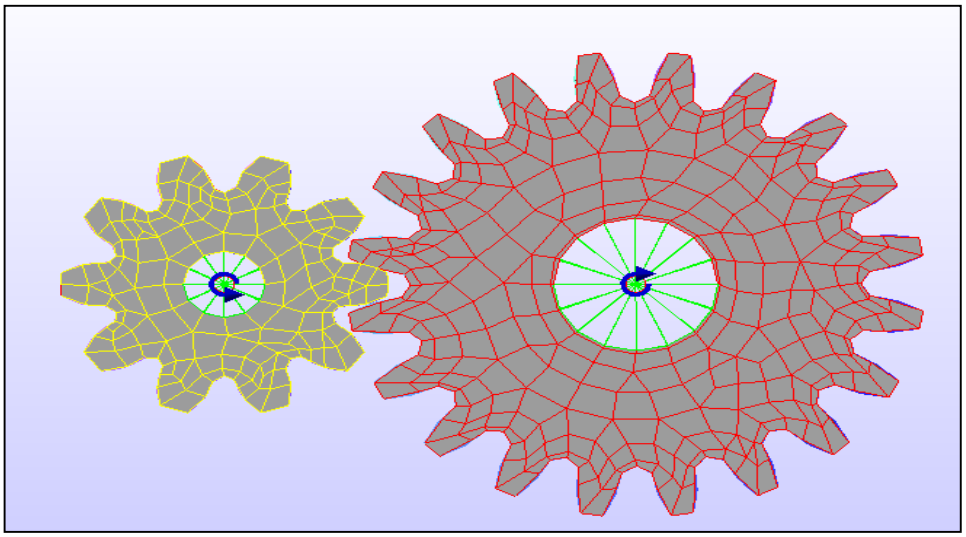
Enter the value of '15' in the Angle (0-90)



Enter a value of '0.01' in the Tolerance value field



2. Defining the surface contact
3. Setting up the Analysis in the FEA Editor environment
    - Element type: Beam
    - Material: ASTM-A36
4. Constraining and loading the pinion
5. Constraining the main gear



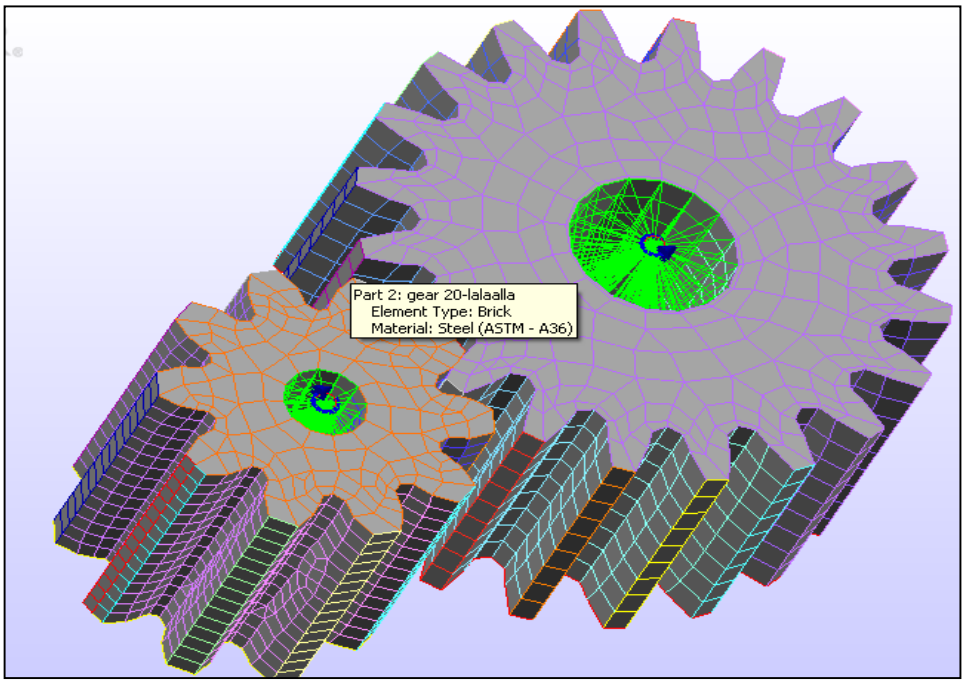


Figure 4.17: The Front view and trimetric view of spur gear

6. Result Evaluation and Presentation

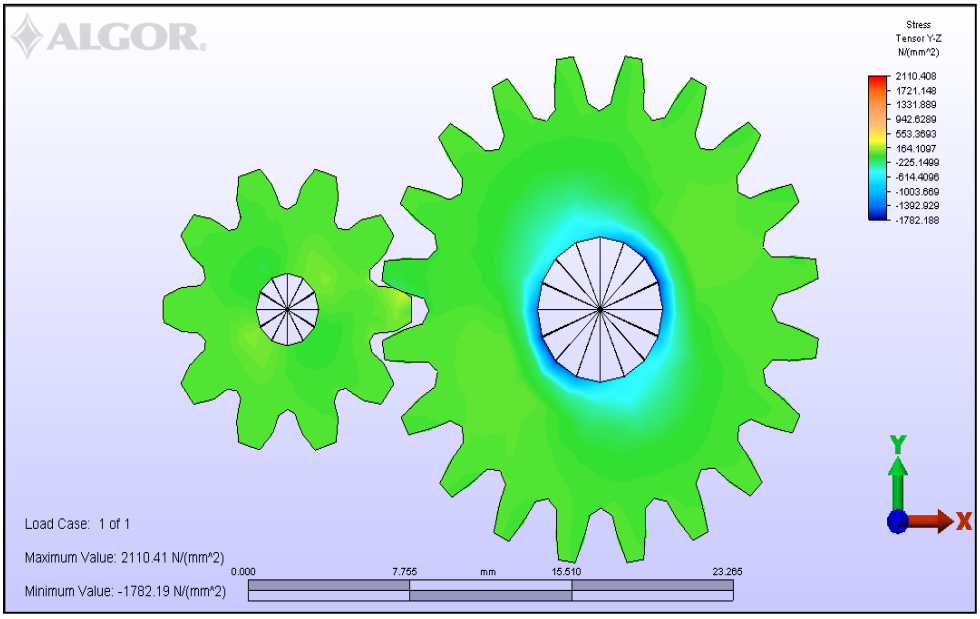


Figure 4.18: The result presentation

In the Figure 4.18 we can shows that the value of stress that we get is between the range 164.1097N/mm^2 and 225.1499N/mm^2. The colour is turn out to be green shows that the stress between the two spur get when we applied the maximum torque we quite stable.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

Car theft is a worldwide crime that affects not only the car's owners, but it also raises insurance rates for everyone who owns an insured vehicle. An anti-theft system is a device or method used to prevent or deter the unauthorized appropriation of items considered valuable especially a car.

Even though auto theft is a crime of opportunity, if a crook really wants a car, they will do whatever it takes to get it regardless of steering wheel locks or car alarms. But with this anti-theft car seat, it can slow them to down, make a car inconvenient to them and, hopefully, discourage them from attempting to steal a vehicle.

If anti theft car seat is used, an individual can secure his or her vehicle and feel safe in knowing that the vehicle is protected. Therefore, anti theft car seat serve as a way of gaining considerable peace of mind. It is recommended that an individual incorporate anti theft car seat so that they maximum a vehicle’s level of protection

5.2 RECOMMENDATION

For future studies and research, this project needs several improvements so that this project can carry out better. For future enhancement it is recommend remaking the remote control system using the radio frequency circuit. The range distance between the radio frequency transmitter and radio receiver circuit is bigger than the Infrared circuit.

The second recommendation is remake the design of circuit that can control 2 motor in one circuit. It is enhancement to make only one system to control the both mechanism and also the whole seat. The last is improving the gearing system to replace the current mechanism system. The profiles of the gear need to be improve to increase the strength of the mechanism so that it can be used in the long term situation.

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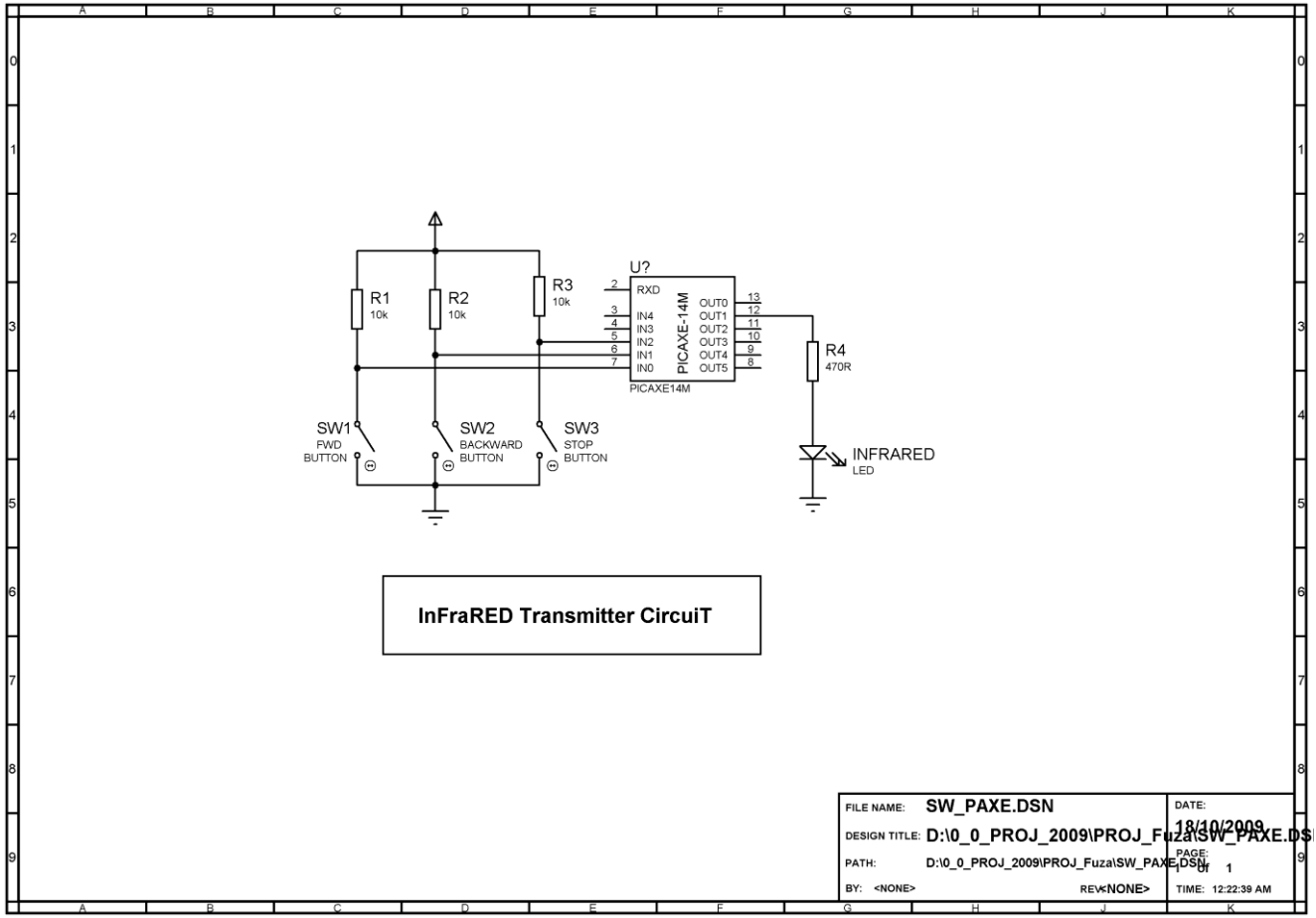
APPENDICES

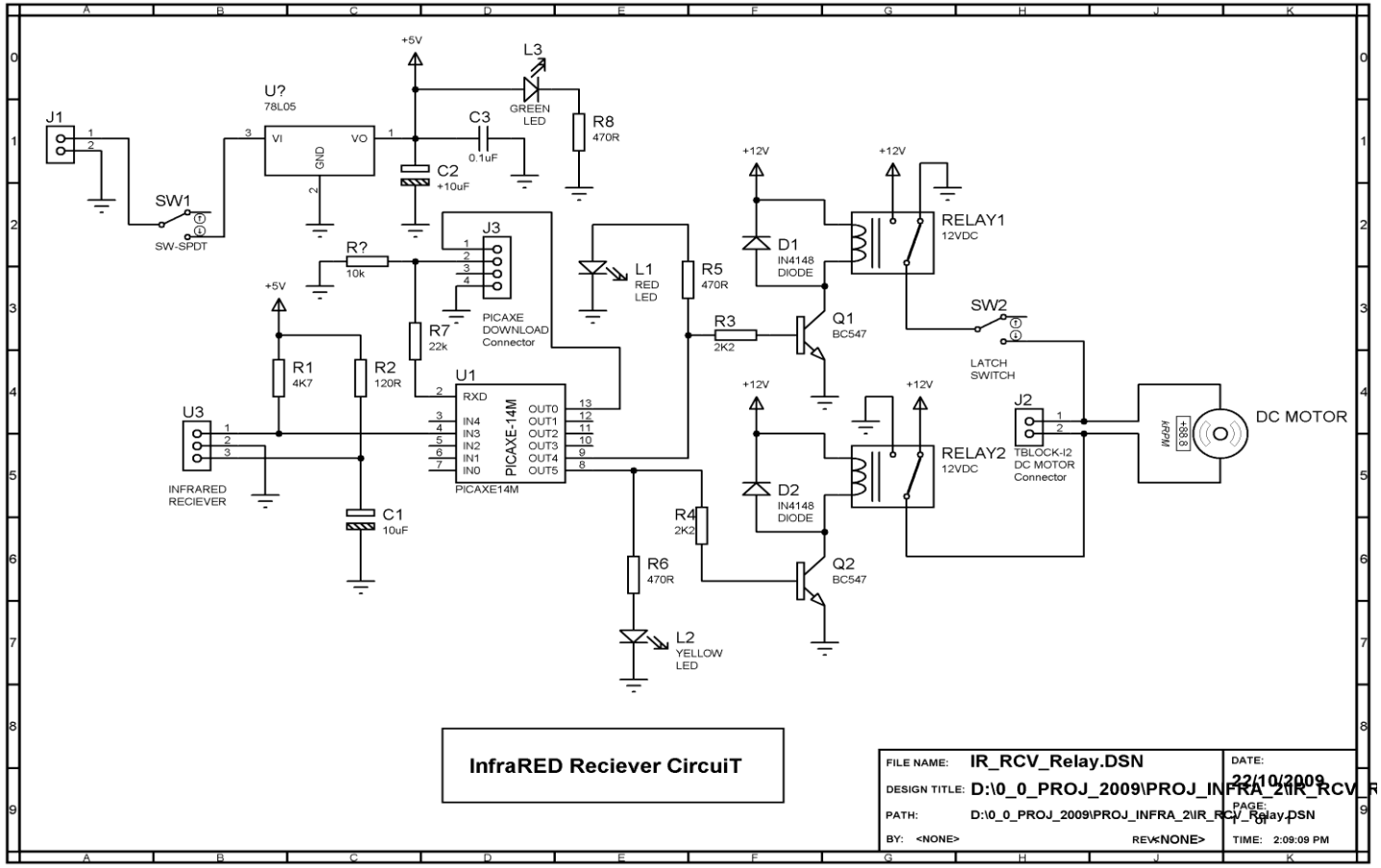
APPENDIX A

Sample of Schematic Diagram Of Infrared Transmitter Circuit



APPENDIX B

Sample of Schematic Diagram of Infrared Receiver Circuit



APPENDIX C

Sample Code for the PICAXE14M Transmitter

```
'************************
'*      Infrared Tx         *
'*    with 3 Button       *
'*  CPU = PAXE-14  *
'*      Mhz= 4MHz       *
'*             OK            *
'************************

symbol    Button1 = PIN0
symbol    Button2 = PIN1
symbol    Button3 = PIN2


symbol Down = 0
symbol Infradata = b0


Here:
    IF Button1 = Down THEN Down1

    IF Button2 = Down THEN Down2

    IF Button3 = Down THEN Down3

    goto Here

Down1: infradata = 0
      goto Infrasend

Down2: infradata = 1
      goto Infrasend

Down3: infradata = 2
      goto Infrasend


Infrasend:
        INFRAOUT 1, infradata
        pause 45
        goto Here
```

APPENDIX D

Sample Code for the PICAXE14M Receiver

```
'************************
'*  Infrared RCV        *
'*                       *
'*  CPU = PAXE-14  *
'*    Mhz= 4MHz         *
'*       OK             *
'************************

symbol    Led1 = 5
symbol    Led2 = 4

        LOW Led2
        HIGH Led1

Here:  INFRAIN2
      BRANCH infra, (Move1, Move2, Move3)
        LOW Led2
        HIGH Led1
        GOTO Here

      '============
      'Move FORWARD
      '============
Move1:  LOW Led2     '
       LOW Led1
       GOTO Here


      '=============
      'Move BACKWARD
      '=============
Move2:  HIGH Led1
       HIGH Led2
       GOTO Here


      '==========
      'STOP Motor
      '==========
Move3:  LOW Led2
       HIGH Led1
       GOTO Here
```

APPENDIX E

Sample of Project schedule for PSM 1

Project planning/Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Get briefing from SV	■													
Define Problem statement		■												
Identify Objective and Scope of project			■											
Literature review				■	■	■	■	■	■	■				
Study of flow process Of project						■	■	■	■	■				
Study software (PSPICE)						■	■	■	■	■	■	■	■	
Detailed Methodology Design circuit/Run circuit/											■	■	■	
Presentation preparation													■	
PSM 1 presentation/Submit report 1														■

APPENDIX F

Sample of Project schedule for PSM 2

Project planning/Weeks	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Review analysis of circuit	■	■												
Fabricate The circuit			■	■	■									
Install circuit to mechanism						■								
Testing							■	■						
Results								■	■	■				
Discussion									■	■	■			
Presentation preparation												■		
Thesis Writing	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PSM 2 Presentation													■	
Thesis submission														■