ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Special Issue
National Conference on Advances in Civil and Mechanical Engineering (NCACME 17)

New Instrumentation System to Ensure the Compliance of RTO Rules by a Four Wheeler

[1] Ismail Shaikh [2] Chinmay Kenkre [3] Drobney Leito [4] Nandan S. [5] Suresh D. Mane [6] Poojesh Anvekar
[1][2][3][4][5] Grijabai Sail Institute of Technology

***Abstract:-* India has grown leaps and bounds in recent times and its economy too is growing. To sustain this growth quality infrastructure is required which includes transport. Road transport is vital in India and is playing a major role. But it is observed that in order to make quick bucks the transport operators overload the trucks/lorries over and above the rated capacity. This leads to accelerated wear and tear of the engine, roads and leads to increased rates of road accidents. Apart from this the engine emissions increase and often go unchecked. To prevent such unauthorized overloading, a device/gadget has been thought of which can convey the driver about overloading and the driver can unload some part of the load on the vehicle to reduce the excessive load. But if the driver continues to drive the vehicle, he will be stopped by the road transport authorities at the toll gates or in the city limits or by the patrolling staff.**

***Keywords:--* Radio Frequency, hertz, Amphere, Voltage, Ohms.**

I. INTRODUCTION

1.1 Overloading and Road Safety:

This project is prepared purely for the purpose to prevent the damage of roads and to prevent unauthorized, unlicensed driving. Roads are now-a-days playing a very important role in every part of the world. We have many more advantages with roads, like they direct the way for communicating other places, time is consumed for reaching from one place to another place etc.

Vehicle dynamics influence the driver's behavior in controlling the vehicle. A heavy vehicle GVW has direct influence on speed, whether the vehicle travels in a vehicle following situation or a free flow condition. The heavier the vehicle, the higher its kinetic energy resulting in greater impact forces and damage – to other vehicles or to the infrastructure – in the event of a crash. An overloaded vehicle is less stable because of the increased height at the centre of gravity and more inertia of the vehicle bodies. An overloaded truck will experience loss of motility and maneuverability.

1.2 Risks of overloading a vehicle:

- The vehicle will be less stable, difficult to steer and the stopping distance of the vehicle will also increase. Vehicles react differently when the maximum weights which they are designed to carry are exceeded.
- Overloaded vehicles can cause the tyres to overheat and wear rapidly which increases the chance of premature, dangerous and expensive failure or blow-outs.
- The driver's control and operating space in the overloaded vehicle is diminished, escalating the chances for an accident.
- The overloaded vehicle cannot accelerate as normal, making it difficult to overtake.
- At night, the headlights of an overloaded vehicle will tilt up, blinding oncoming drivers to possible debris or obstructions on the roadway
- Brakes have to work harder due to 'the riding of brakes' and because the vehicle is heavier due to overloading brakes overheat and lose their effectiveness to stop the overloaded vehicle.

II. LITERATURE REVIEW

Mohamed Rehan Karim, Ahmad Saifizul Abdullah, Hideo Yamanaka, Airul Sharizli Abdullah1, Rahizar Ramli, " Degree of Vehicle Overloading and its Implication on Road Safety in Developing Countries", found that the phenomenon of vehicle overloading is not new and has been discussed in relation to the adverse effects on road pavement damage, road safety and GHG emission. Although much has been said in the context of the more developed countries, there has not been much discussion on vehicle overloading in developing countries. In this study, the extent and degree of vehicle overloading in a developing country is established.

Chan Ying Chuen, Dr Jonathan Bunker, Prof. Arun Kumar, (2006) "Overloading truck traffic study and

ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Special Issue
National Conference on Advances in Civil and Mechanical Engineering (NCACME 17)

strategy to minimise it", overloaded truck traffic is a significant problem on highways around the world. Developing countries in particular, overloaded truck traffic causes large amounts of unexpected expenditure in terms of road maintenance because of premature pavement damage. Overloaded truck traffic is a common phenomenon in developing countries, because of inefficient road management and monitoring systems.

III. MECHANICAL COMPONENTS

3.1 Main parts of the chassis

3.1.1 Chassis frame
Mild steel
3.1.2 Drive axle
C30 steel
3.1.3 Front axles
C30 steel
3.1.4 Ball bearing housing
Mild steel
3.1.5 Wheel holding plates
Mild steel
3.1.6 Wheels
Fiber
3.1.7 Drive sprocket
C30 steel
3.1.8 Driven sprocket
C30 steel
3.1.9 Bush for drive sprocket
Mild steel
3.1.10 Bush for driven sprocket
Mild steel
3.1.11 Motor holder
Mild steel
3.1.12 Motor for drive
12VDC, 3amps, 32rpm
3.1.13 Chain
C30 steel
3.1.14 Vertical supports for tray
Mild steel
3.1.15 Cabin holders, rear side
Mild steel
3.1.16 Cabin holders, front side
Mild steel
3.1.17 Limit switch holder
Mild steel
3.1.18 Bearing housing holder
Mild steel
3.1.19 Ball bearings
Standard
3.1.20 Tray
Galvanized-sheet, t=1.5mm
3.1.21 Cabin
Galvanized sheet, t=1.5mm
3.1.22 Batteries
6VDC, 4.5Ah
3.1.23 Battery holder
Mild steel
3.1.24 Siren
12VDC, 3amps
3.1.25 Receiver circuit
Electronic
3.1.26 Transmitter circuit
Electronic
3.1.27 License card insertion set
Styrofoam
3.1.28Control circuit for license card sensing
Electronic
3.1.29 Battery charger, control wiring and switches
Electronic

3.2 Processes involved in making various parts

3.2.1 Chassis

Chassis is made of mild steel being cut out of size of 20mmx 20mm x 4mm thick of length 350mm-1nos, 290mm-1nos, 700mm-2nos, all these hammered for straightening and then ground to remove the cutting burr. These are then joined to make the frame as per the sketch and then ground to remove the welding burr and cutting burr. The other parts of the vehicle are also welded on the chassis like battery, cabin and tray holding clamps.

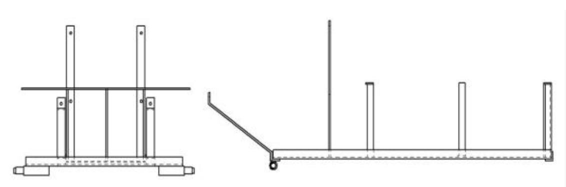


Fig 3.1 Sketch of the chassis

3.2.2 Vertical supports for the tray

Vertical supports are made of mild steel angle being cut from the size of 20mm x 20mm x 4mm of length 430mm-1nos, 155mm-2nos, they are hammered for flattening and then welded to make the vertical supports as per the sketch. Such two set are made and welded to the chassis frame. The tray will be fixed on these supports.

ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Special Issue
National Conference on Advances in Civil and Mechanical Engineering (NCACME 17)

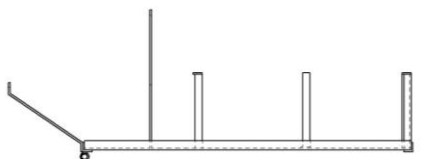


Fig 3.2 Vertical supports for the tray

3.2.3 Front axle

Front axle is made of C30 steel round bar of diameter of 25mm and length 90mm is turned on lathe machine to reduce the diameter to 20mm and step turned to a diameter of 15mm to suit the ball bearing inner diameter of length 25mm. The 25mm step turned part is again reduced to 12mm to suit wheel plate of length 5mm. It is then faced from the other side to the required total length as per the sketch. The sketch is shown in the Fig.3.3.

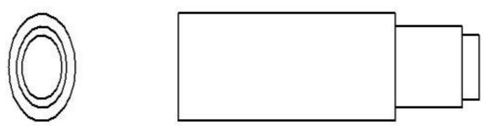


Fig 3.3 Front axle

3.2.4Rear Axle

Rear axle is made of C30 steel round of diameter 25mm and length 410mm which is turned on lathe to reduce the diameter to 20mm and step turned to a diameter of 15mm as to suit the ball bearing inner diameter for the length of 55mm. It is further step turned to a diameter of 12mm for 5mm length to suit the wheel holding plate.

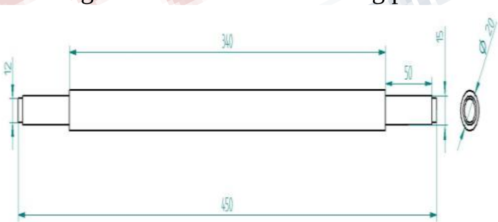


Fig. 3.4 Rear axle

3.2.5 Ball bearings

The ball bearings used are standard ball bearings of outer diameter 35mm, inner diameter 15mm and a of thickness 10mm. Four such ball bearings are used in this project. D= 45mm, B=15mm, d=15mm.

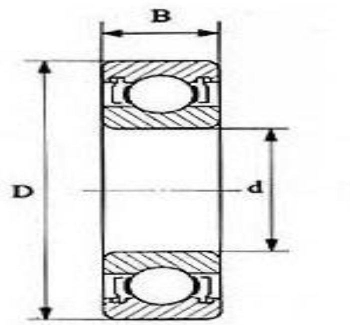


Fig. 3.5 Standard ball bearing

3.2.6 Ball bearing housing

The housings are made of mild steel round bar turned to a diameter of 50mm for the length of 20mm and then turned on lathe machine to make the diameter as 45mm. These are then drilled to a diameter of 16mm and counter bored to a diameter of 35mm to suit the ball bearing outer diameter for the depth of 10mm. Housings are then faced from the other side to make the total length as 15mm. Four such ball bearing housings are made for this project.

3.2.7 Bearing housing holders

They are made out of mild steel angle 40mm x 40mm x 5mm. The length of the holders is 25mm, such two number of bearing housing holders are made. Holes of 10mm diameter are drilled and welded on the chassis to hold the rear axle bearing housings with bearings.

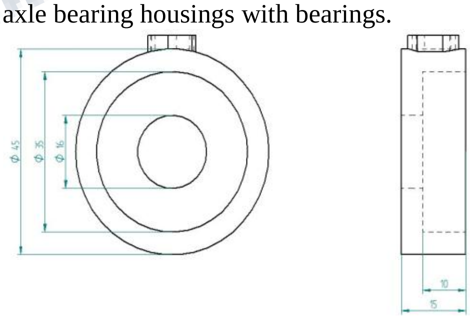


Fig. 3.6 Ball bearing holders

3.2.8 Drive sprocket & driven sprocket

It is made of standard C30 steel sprocket being used in a bicycle having 75mm outer diameter, 34mm inner diameter and thickness 14mm with 16 number of teeth's. The sprocket is welded to the rear axle.

ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Special Issue
National Conference on Advances in Civil and Mechanical Engineering (NCACME 17)

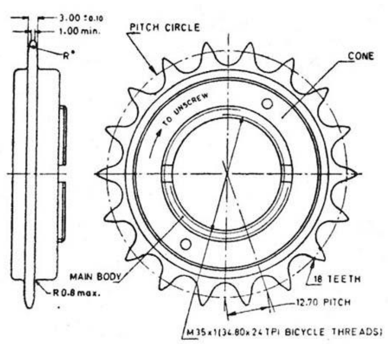


Fig. 3.7 Standard drive & driven sprocket

3.2.9 Bush for drive sprocket

It is made of mild steel rod of diameter 40mm and length 30mm. The rod is turned on lathe machine to reduce the diameter to 34mm to suit the sprocket inner diameter and step turned to a diameter of 20mm for 15mm length. It is drilled to 10mm diameter hole and faced from the side to 34mm diameter and length as 14mm. On the 20mm circumference drilling and tapping of M6 is done to secure it with the motor axle. This bush is then welded to the drive sprocket.

3.2.10 Bush for driven sprocket

It is made of mild steel round rod of diameter of 40mm of length 20mm. The rod is turned on lathe machine to a diameter of 34mm to suit the sprocket inner diameter. A 14mm diameter hole is drilled for 20mm length to suit the axle diameter and then faced to make the total length as 14mm. This bush is then welded to the driven sprocket.

3.2.11 Limit switch holder

It is made of mild steel flat being cut from 20mm x 4mm thick plate to a length of 160mm and 70mmrespectively. Both are hammered for flattening, four holes are drilled on the 70mm flat to suit the limit switch holes as per the sketch. Both the 60mm and 160mm flats are welded to the chassis frame as per the sketch.

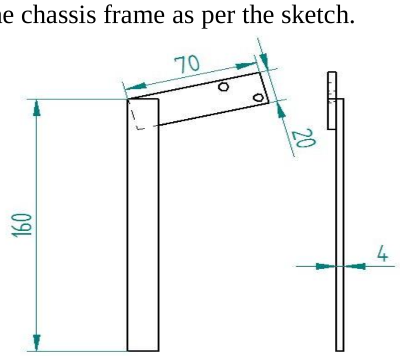


Fig. 3.8 Limit switch holder

3.2.12 Motor holder

It is made of mild steel flat being cut from a sheet of 20mm x 3mm to a length of 235mm. It is bent to make the ring of 75mm diameter to hold the motor from outside. Such two rings are joined together and holes are made on both the flats of diameter 10mm for M10 nuts.

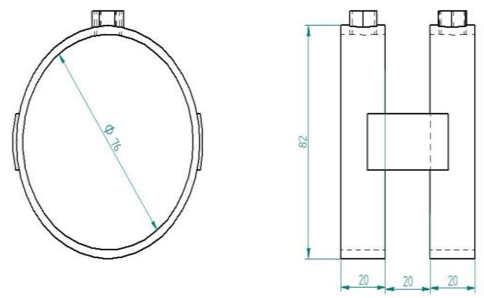


Fig. 3.9 Motor holder

3.2.13 Motor

The motor used is a 12V 3amps DC motor. Such motors are used in automobile wipers. They are used to for cranking mechanism. The motor used has a speed of 32 rpm. Its shaft has an worm gear which is connected to the spur gear, and the same shaft of the spur gear connects the sprocket.

Fig. 3.10 Wiper motor

3.2.14 Wheels

The wheels used are nylon wheels used in small carts. The wheels have a diameter of mm. Holes of mm diameter are drilled on the rear wheels for the bolts of the wheel plate and front wheels are attached using bushings.

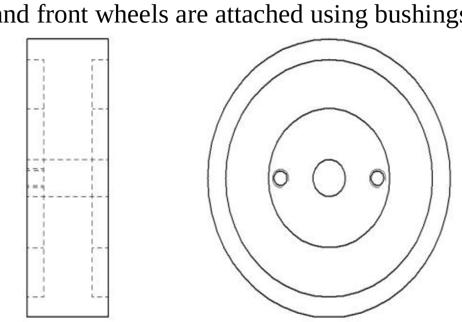


Fig. 3.11 Nylon wheels

ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Special Issue
National Conference on Advances in Civil and Mechanical Engineering (NCACME 17)

3.2.15 Wheel holding plates

Wheel holding plates are the standard washers of diameter 75mm. Holes are drilled on these plates at the centre of 12mm diameter. Pitch circle is marked at 60mm diameter and two holes on that pitch circle of 8mm are drilled for the bolts to fix the wheels. These plates are welded to the rear and front axles ends. Such four plates are made for this project.

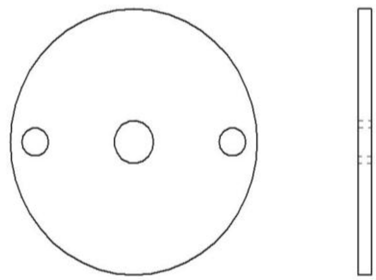


Fig. 3.12 Wheel holding plates

3.2.16 Cabin holders

Cabin holders are made of MS-flat of size 20mm x 4mm x 300mm. Such two strips are hammered for flattening and then marked for the holes at the distance of 135mm from one side. A hole is drilled of diameter 6mm for the bolt and second hole is drilled at the distance of 150mm from first hole. Such two numbers of cabin holders are welded to the chassis.

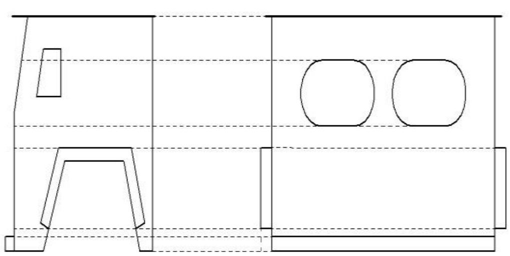


Fig.3.13 Cabin holder and cabin

3.2.17 Battery box

Battery box is also made of MS-flat of size 12mm x 3mm x 340mm. It is hammered for flattening and then marked for the bending to make rectangular shape out of 340mm flat for the outer size of 100mm x 70mm. These are then welded and joined together to make a U- shape with 50mm legs and 70mm straight and welded to a rectangular frame to make the box structure to hold the battery.

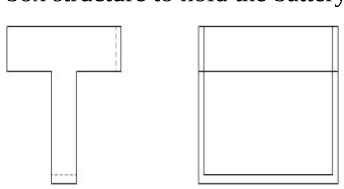
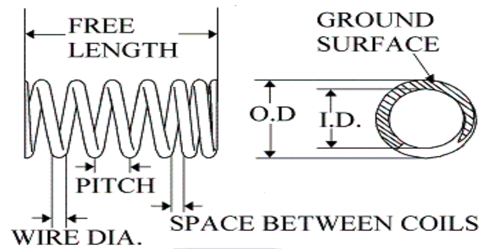


Fig. 3.14 Battery box

3.2.18 Springs

Springs are made of 0.8mm diameter spring steel wire wound to the outside diameter of 16mm for the closed height of 25mm with 14 numbers of coils. Such four numbers of springs are used in this project each at the tray holders.



Free length = 52mm
Pitch = 4.2mm
Inner diameter = 12mm Outer diameter = 14mm
Wire diameter = 1mm

Fig. 3.15 Compression spring

3.3 Design of the spring

Deflection of helical compression spring

Total length of wire, l = length of active coils × number of active coils

Therefore, $l = \pi Di$

Axial deflection of spring y= θ×D/2 where θ is the angular deflection.

We know,

$$\frac{T}{J} = \frac{\tau}{d/2} = \frac{G\theta}{l}$$

$$\theta = \frac{Tl}{GJ} = \frac{F \times D/2(\pi Di)}{G\left(\frac{\pi}{32}\right)d^3}$$

Angular deflection $\theta = \frac{16FD^2i}{Gd^4}$

Hence axial deflection $y = \theta \times \frac{D}{2} = \frac{16FD^2i}{Gd^4} \times \frac{D}{2}$

Therefore $y = \frac{8FD^3i}{Gd^4}$

Stiffness $Fo = \frac{F}{y} = \frac{F}{\frac{8FD^3i}{Gd^4}}$

Therefore,

$$Fo = \frac{d^4G}{8D^3i}$$

Observations:

Material of the spring = Cr-Vd steel
Outer diameter of the coil, Do =D = 14mm
Inner diameter of the coil, Di = 12 mm

ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Special Issue
National Conference on Advances in Civil and Mechanical Engineering (NCACME 17)

Free length of the spring, l = 52mm
Diameter of the wire, d = 1mm
Number of active turns, i = 10
Total number of turns = (i + 2)= (10+2) = 12

Modulus of rigidity , G = 79300 Mpa
Deflection of the spring, y = 27mm

1. ***Spring index,***

C = D/d

C = 14/12

C = 1.66

l = (10+2)1 + 27 + 5

l = 44 mm

2. ***Pitch,***

$P = \frac{l-2d}{i}$

$= \frac{44-(2\times1)}{10}$

P = 4.2 mm

3. ***Actual deflection of the spring,***

$y = \frac{8FD^{\wedge}3i}{Gd^{\wedge}4}$

$y = \frac{8\times9.75\times14^{\wedge}3\times10}{79300\times1^{\wedge}4}$

y = 26.99mm

3.4Design of axle:

Data :

1. Diameter of the sprocket = 75mm
2. Distance between the sprocket and bearing = 168mm
3. Motor torque, Mt = 10 Kg-m

We have,

Mt = 10×1000×9.81
= 98100 N-mm

Also,

$Mt = \frac{9.55\times10^6(P)}{n}$

$98100 = \frac{9.55\times10^6(P)}{31}$

P = 0.3287 KW

For C40 steel,

$\sigma_y = 324$ N/mm^2

$\tau_y = \sigma_y/2$

= 324/2

= 162 N/mm^2

Taking Factor of Safety = 3

τ_y = 162/3

= 54 N/mm^2

Outer diameter of the shaft,

$D = \{\frac{(16\times Kr\times Mt)}{\pi\times\tau y}\}^{\wedge 1/3}$

Kr = velocity ratio of inside to outside diameter = 1

$D = \{\frac{(16\times1r\times98100)}{\pi\times54}\}^{\wedge 1/3}$

D = 20.99 ~ 21 mm

At low velocities, the reaction between chain tension is given by

$\frac{T1}{T2} = e^{\wedge\mu\theta}$

Assuming,

θ = 180˚

μ = 0.3

$e^{\wedge\mu\theta}$ = 2.56

Therefore,

$\frac{T1}{T2}$ = 2.56

T1 = 2.56T2 -------- Eq (1)

Also,

Mt = (T_1-T_2)r

98100 = (T_1-T_2)25

(T_1-T_2) = 3924 -------- Eq (2)

Substituting the value of T1 in Eq (2) we have,

(T_1-T_2) = 3924

$(2.56T_2-T_2)$ = 3924

$1.56T_2$ = 3924

T_2 = 2515.38 N-mm

Substituting T_2 in Eq (1) ,

$T_1 = 2.56\ T_2$

$T_1 = 2.56 \times 2515.38$

T_1 = 6439.38 N-mm

Vertical load on the sprocket,

$\frac{T1}{T2} = \frac{6439.38}{2515.38}$

= 2.56 N-mm

Horizontal load on the sprocket,

$T_1 + T_2$ = 6439.38 + 2515.38

= 8954.76 N-mm

***3.5Design of gears*:**

Known parameters,

1. Material of the worm gear: Phosphor-bronze
2. Material of the worm wheel: Plastic
3. Teeth profile: 20˚ involute system
4. Speed of worm gear, N_1 = 200rpm
5. No. of teeth on the worm gear, Z_1 = 7
6. Torque, T = 0.6439 N-m

ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Special Issue
National Conference on Advances in Civil and Mechanical Engineering (NCACME 17)

Velocity ratio,

$i = \frac{N1}{N2} = \frac{Z1}{Z2}$

$i = \frac{46}{7}$

$i = 6.57$

Speed of the worm wheel,

$i = \frac{N1}{N2}$

$6.57 = \frac{200}{N2}$

$N_2 = 31.44 \sim 32$ rpm

Centre distance,

$a = \frac{(d1+d2)}{2}$

$a = \frac{(10+55)}{2}$

$a = 32.5$ mm

Diametral pitch,

$P_d = \frac{Z1}{d2} = \frac{1}{m}$

$P_d = \frac{Z1}{d2} = \frac{7}{10}$

$P_d = 0.7$

$P_d = \frac{1}{m} \quad 0.7 = \frac{1}{m}$

$M = 1.42$ mm

Standard module m = 1.5

Lead of the gear,

$l = Z_1 P_2$

$P_2 = \frac{\pi d2}{Z2}$

$P_2 = \frac{\pi \times 55}{46}$

$P_2 = 3.7562$ mm

$l = 7 \times 3.75$

$l = 26.29$ mm

Lead angle,

$\tan \gamma = \frac{l}{\pi d1}$

$\tan \gamma = \frac{26.29}{\pi \times 10}$

$\tan \gamma = 0.8369$

$\gamma = 39.64^\circ$

Power,

$P = \frac{2\pi NT}{60000}$

$P = \frac{2\pi \times 200 \times 0.6439}{60000}$

$P = 0.01348$ KW

Torque at the gear,

$T = \frac{P \times 60}{2\pi}$

$T = \frac{0.01348 \times 60}{2\pi}$

$T = 4.02$ N-m

Pitch line velocity of the worm gear,

$v = \frac{\pi d 2N}{60}$

$v = \frac{\pi \times 55 \times 10^{\wedge}-3 \times 32}{60}$

$v = 0.09215$ m/sec

Tangential tooth load,

$Ft = \frac{1000 P \times Cs}{v}$

$Ft = \frac{1000 P \times Cs}{v}$

Cs = Service factor

v = pitch velocity

From table

For medium shocks and 8 to 10 h working per day

$Cs = 1.50$

$Ft = \frac{1000 \times 0.0.01348 \times 1.50}{0.09215}$

$Ft = 219.42$ N

Velocity factor,

$Cv = \frac{6.1}{6.1+v}$

$Cv = \frac{6.1}{6.1+0.09215}$

$Cv = 0.9815$

Form factor,

Using Cv, form factor for 20˚ involute teeth from table

$y = 0.125$

Allowable static stress for gear,

Since the gear is made of plastic, allowable static stress for gear

$\sigma_p = 58.8$ N/mm^2

Permissible tooth load,

$Ft_1 = \sigma_p \times Cv \times b \times Y \times m$

Face width,

b = 9.5m

b = 9.5×1.5

b = 14.25 mm

Form factor, $Y = \pi \times y$

$Y = \pi \times 0.125$

$Y = 0.3926$ mm

Therefore,

$Ft_1 = \sigma_p \times Cv \times b \times Y \times m$

$Ft_1 = 58.8 \times 0.9815 \times 14.25 \times 0.3926 \times 1.5$

$Ft_1 = 484.31$ N

Since the permissible tooth load is greater than the tangential tooth load the design is safe.

Dynamic strength of gear,

$Fd = \sigma_d \times b \times Y \times m$

ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Special Issue
National Conference on Advances in Civil and Mechanical Engineering (NCACME 17)

Fd = 58.8×14.25×0.3926×1.5
Fd = 493.43 N
Also the dynamic strength Fd of the gear is greater than Ft the design is safe to withstand dynamic load.

IV. ELECTRICAL COMPONENTS

4.1 DC Motor

A motor is a machine, especially one powered by electricity or internal combustion that supplies motive power to a vehicle or any other device. There are different of types of motors used. The motors used in robotics include DC servomotors, stepper motors and AC. The motor selected for this project is a DC servo motor. The main components of DC servomotors are rotor and stator. Usually, the rotor includes the armature and the commutator assembly and the stator includes the permanent magnet and bush assembly. When current flows through the winding of the armature it sets up a magnetic field opposing the field set up by the magnets

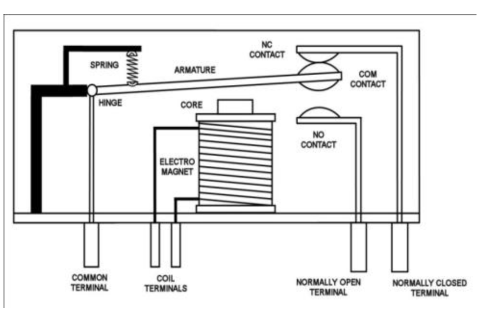
4.1.1 Selection of a DC motor
Characteristics

1. System voltage: 12V
2. Operating temperature: 20˚C to +90˚C
3. Current: 3.8 amps
4. Rated torque at output gear: 18-25 Nm @ 12V
5. Operating speed: 30 rpm

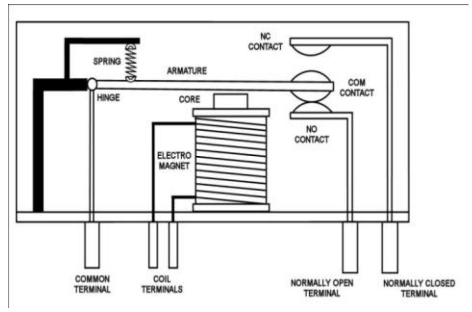
In order to select the DC motor of a specific application the following procedure is adopted.

4.2 Relay

A relay is a simple electromechanical switch made up of an electromagnet and a set of contacts. Relays are found hidden in all sorts of devices. In fact, some of the first computers ever built used relays to implement Boolean gates.



When the circuit is OFF



When the circuit is ON

Fig. 4.1 Construction of a relay

4.3 Capacitor

A capacitor is a device for storing charge and electrical energy. In its simplest form it consists of two parallel conductors of any shape separated from each other by a narrow gap which may be empty or filled with one or more dielectric materials.

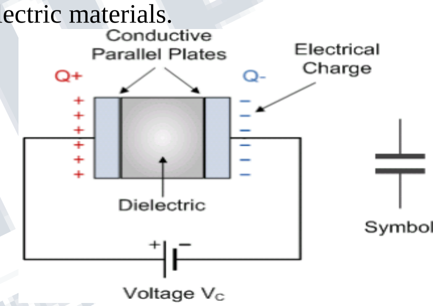


Fig. 4.2 Capacitor

4.4 Resistor

According to ohms law:

"Electrical resistance of a conductor is the effective opposition offered by the conductor to the now of charges through it and is defined as the rate of potential difference between the ends of the conductor to the current flowing through the conductor. The SI unit of resistance is the Ohm (Ω).

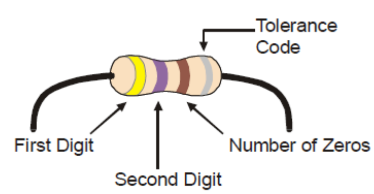


Fig. 4.3 Resistor

4.5 Transistor

A transistor is a 3 terminal two junction semi-conducting device whose basic action is amplification. There are two types of transistors (i) N-P-N transistor. (ii) P-N-P transistor.

In our circuit we have used a N-P-N transistor. Symbolically it is shown below:

ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Special Issue
National Conference on Advances in Civil and Mechanical Engineering (NCACME 17)

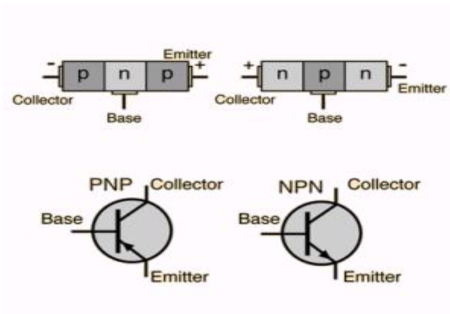


Fig 4.4 Transistor

4.6 Diodes

It is a combination of P-type and N-type semiconductors. Or a P-N junction is called a crystal diode or a semiconductor diode. Symbolically it has shown in the figure below.

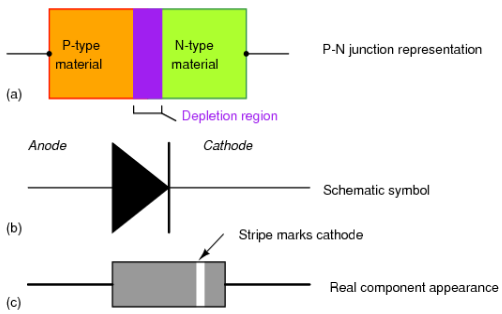


Fig. 4.5 Diodes

4.7 Power supply

The entire circuit is run on a 12V DC battery. This 12V is reduced down to 5V using resistors. This reduction is done to match the voltage of the IC used, without which it would burn off. Also the whole circuit runs on 5V supply. Two 6V batteries are connected in series which provides 12V.

4.8 RF Transmitter

An RF transmitter module is a small PCB Sub-assembly capable of transmitting a radio wave and modulating that wave to carry data. Transmitter modules are usually implemented alongside a micro-controller which will provide data to the module which can be transmitted. RF transmitters are usually subject to regulatory requirements which dictate the maximum allowable transmitter power output, harmonics and band edge requirements.

Fig. 4.5 RF transmitter

4.9 RF Receiver

An RF receiver module receives the modulated RF signal, and demodulates it. There are two types of RF receiver modules: super-heterodyne receivers and super-regenerative receivers. Super-regenerative modules are usually low cost and low power design using a series of amplifiers to extract modulated data from a carrier wave. Super-regenerative modules are generally imprecise as their frequency of operation varies considerably with temperature and power supply voltage. Super-heterodyne receivers have a performance advantage over super-regenerative; they offer increased accuracy and stability over a large voltage and temperature range.

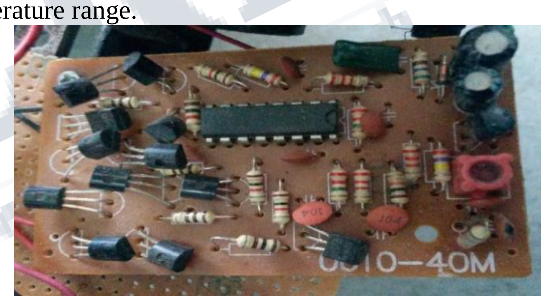


Fig. 4.6 RF receiver

V. WORKING

5.1 Working of the truck

The four wheel vehicle is being moved by a DC motor drive through chain sprocket mechanism. It consists of a cabin and a trolley for carrying load. In normal conditions, when the switch to start the vehicle is put on it closes the circuit and current flows through the circuit. For the vehicle to start moving the motor circuit is to be switched on. The DC motor connected to the rear axle via sprocket and chain mechanism starts, moving the vehicle. Load carrying trolley has cushioning springs, these springs are set for a particular load and if overloaded, will activate the micro-switch to trigger the control circuit to indicate the small light on the dash board and sound a buzzer so that it conveys the driver that the vehicle is overloaded.

When the truck is overloaded it increases the force acting on the springs which tends to compress the springs. Due to this compression, the load carrying tray displaces downwards activating the limit switch. This limit switch

ISSN (Online) 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Special Issue
National Conference on Advances in Civil and Mechanical Engineering (NCACME 17)

sends a signal to the relays activating the small buzzer. The buzzer will be stopped when the load on the tray is reduced. If the driver tries to bypass the ignition connection the vehicle can be started. If the driver tends to move the vehicle with overload, the buzzer sounds continuously which is heard by the driver only.

When the vehicle is moving on road and when it comes across the police station or check-post, it is sensed by the vehicle through radio remote frequency receiver circuit within the vehicle (radio remote frequency are continuously transmitted by the check post or police station or police vehicles of the same frequencies) which is received and the control circuit will trigger the siren on, drawing the attention of the police enforcer or authorities to stop the vehicle and penalize and force to unload the extra load.

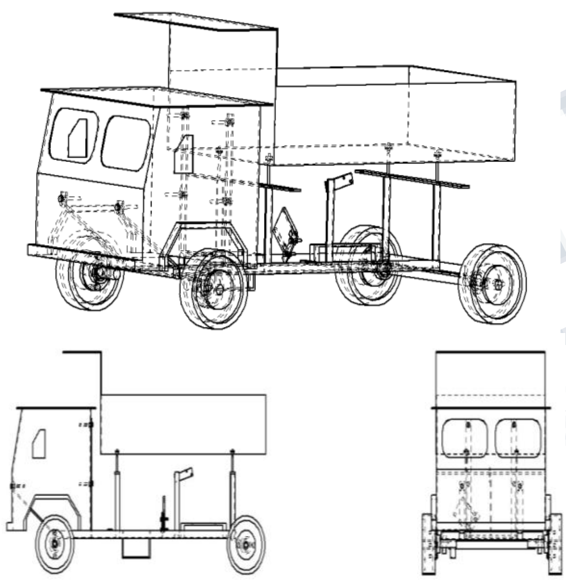


Fig. 5.1, 2-D sketches of the truck

The next feature of this project is the license card insertion, here we have a special card with the magnet in it, and in actual it will be detecting the magnetic strip. Here once the card is inserted, the magnet is detected which closes the magnetic sensor provided at the place, which will give input to the control circuit, to connect the ignition, here it is the motor connection for the drive. In the absence of the license card insertion, the connection will not effect, and even if we put on the button for starting, the vehicle drive motor will not connect.

If either of the parameter is not followed, the buzzer sounds and when it comes near the check-post or any police station, the siren in this vehicle starts which draws the attention of the authorities who will make the vehicle to stop and penalize according to law. If the driver when caught near the check post tries to flee away with vehicle, if not stop when asked to, the police from their radio frequency signals can stop the fleeing vehicle. The remote control of the RTO authorities will have a radio frequency same for all the vehicles and this frequency will also match with the radio frequency of the vehicle.

VI. ADVANTAGES

- Automation of the load inspection by the vehicle and on the vehicle itself.
- Vehicle is not assessable to the unlicensed or unauthorized driver.
- Low initial investment.
- Low maintenance cost.
- Damage of roads can be prevented.
- System is reliable.
- System can be easily built up on vehicles and easy to maintain.
- Easy for the enforcing authorities to control since the vehicle itself will indicate the overload.

VII. CONCLUSION

The results of this study may be summarized as follows:

1. Significant GVW violation involving overweight commercial vehicles is observed.
2. The frequency and degree of overloading in heavy commercial vehicles is very significant and alarming.
3. Not only does overloading accelerate pavement damage (which in turn may contribute to accidents), overloaded heavy vehicles would be hazardous to other road users.
4. Monitoring and enhancing enforcement of weight limits of heavy vehicles may be a step in the right direction.
5. Comprehensive and continuous data is needed, especially at critical locations in the road network.

REFERENCES

1. Abbas Mahmoudabadi, and Arezoo Abolghasem (2013), "Application of Chaos Theory in Trucks' Overloading Enforcement", Hindawi Publishing Corporation, Journal of Engineering, Volume 2013, Article ID 245293, 5 pages, http://dx.doi.org/10.1155/2013/245293

2. ARRB Transport Research, (1997). Assessment of truck/trailer Dynamics, Technical Working Paper

No. 31, Contract Report, National Road Transport Commission, ISBN 0 7306 8436 9.

3. Bixel, R.A., Heydinger, G.J., Durisek, N. J., Guenther, D.A., (1998). Effect of loading on Vehicle Handling. SAE Paper 980228, SAE International Congress and Exposition.

4. Campbell, K.L., Blower, D.F., Gattis, R.G., Wolfe, A.C., (1988). Analysis of Accident Rates of heavy Duty vehicles, Final Report, Univ. of Michigan Transportation Research Institute.

5. Conway A., Walton C. M., (2004). Potential application of ITS technologies to improve commercial vehicle operations, enforcement, and monitoring, Research Report SWUTC/04/473700-00069-1, The University of Texas at Austin, Texas.

6. Ceallach Levins, Anthony Ockwell (2000) , “Trucks: the road to ruin or increased efficiency?

7. Directorate for Science, Technology and Industry”, http://www.oecdobserver.org/news/fullstory.php/aid/236 Published: May 12 2000

8. Chan, Ying Chuen (Maple), Bunker, Jonathan M., & Kumar, Arun (2006), “ Overloading truck traffic study and strategy to minimise it. In Proceedings of the Faculty of Built Environment and Engineering Infrastructure Conference 2006, Queensland University of Technology, Queensland University of Technology, Brisbane, Qld. downloaded from: http://eprints.qut.edu.au/41246/

9. CSIR, (1997). The damaging effects of overloaded heavy vehicles on roads, *CSIR Roads and Transport Technology*, 4th Edition, ISBN: 1-86844-285-3.

10. Fancher, P., Mathew, A., Campbell, K., Blower, D., Winkler, C., (1989). Turner Truck handling and Stability Properties Affecting Safety: Final Report. Univ. of Michigan Transportation Research Institute.

11. Fancher, P.S., Mathew, A., (1989). Safety implications of various truck configurations, Vol. III, FHWA-RD-89- 085, The Univ. of Michigan Transportation Research Institute.

12. Friswell R., Ann Williamson, A., (2013). Comparison of the fatigue experiences of short haul light and long distance heavy vehicle drivers. *Safety Science* 57 (2013) 203–213.

13. Huang, Y.H., (1993). *Pavement Analysis and Design*, Prentice-Hall, Englewood Cliffs, NJ.

14. Jacob, B., La Beaumelle, V.F., (2010). Improving truck safety: Potential of weigh-in-motion technology, *IATSS, Research* 34 (2010) 9–15.

15. Jun Li1, Yanzhao Su1, Jinli Xie1,Yangjiao Xu1& Lei Ji1,2(2014),:” Research of the Vehicle Load Control System Integration Device”, Studies in Engineering and Technology Vol. 1, No. 2; August 2014 ISSN 2330-2038 E-ISSN 2330-2046

16. Larue, G.S., Rakotonirainy, A., Pettitt, A.N., (2011). Driving performance impairments due to hypovigilance on monotonous roads. *Accident Analysis and Prevention* 43, 2037–2046.

17. Liu, Y.C., Wu, T.J, (2009). Fatigued driver’s driving behavior and cognitive task performance: Effects of road environments and road environment changes. *Safety Science* 47 (2009) 1083–1089.