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DESIGN AND FABRICATION OF SEAT BELT ASSISTED HANDBRAKE RELEASE

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Abstract

The Formula student competition challenges teams of university undergraduate and graduate students to conceive, design, fabricate, develop and compete with small prototype formula type vehicle. Hand brake is one of the most important components in vehicles. In general, the hand brake is operated manually. In our project we are developing hand brake when Seat belt is not acquired off for safety purpose. Major causes of death in road accidents are carelessness in safety while driving. In 2012, more than half of all people who died on Utah's roadways weren't buckled. Hence wearing seat belts might have reduced serious crash related injuries and saved life. Hence "Driver Assistive Safety System" (DASS) comprises of techniques which inculcate the mandatory safety precautions via ignition. This project describes safety system which ensures that the driver and co passenger wear safety seat belt while driving a car. The driver assistive safety system works on 'HAND BRAKE REALESE" concept.

Keywords: Rachet mechanism, Arduino, Wheel-drum brake mechanism

I. INTRODUCTION

In road vehicles the parking brake also called as hand brake, emergency brake or e-brake is used to keep the vehicle stationary. In normal vehicles a hand brake is consist of a cable connected to two-wheel brakes at one end and the other end to a pulling mechanism which is operated by human with hands. The main purpose of this project is to ensure drivers safety through a modified handbrake in car. A handbrake is an additional braking mechanism installed on all commercial vehicles that's completely separate from foot pedal operated. In cars the parking brake, also called hand brake, usually used to keep the vehicle stationary. Most commonly used to prevent the vehicle from rolling when it is parked. Automobile hand brakes consist of a cable directly connected to the brake mechanism on one end and to a lever at the driver's position. Using your handbrake to stop a moving car can damage the brake system. In this project we have designed the mechanism which is used to operate hand brake using seat belt assist. While removing the hand brake this mechanism or system ensures that seat belt is plugged in by the driver. As the driver acquire seat belt the hand bake gets free and can be removed.

II. Methodology

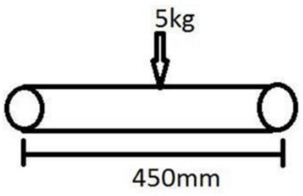
In this project we are going to study about E-brakes. Automobiles e-brakes usually consist of a cable directly connected to a brake mechanism on one end and to some type of mechanism that can be actuated by the driver. The model is manufactured by assembling the various components and then the testing is carried out & result & conclusion is drawn.

a. Problem Identification
b. Setting up an Objective
c. Literature Survey of existing system
d. Market survey for components
e. Analytical Calculations
f. 3D designing of proposed model
g. Purchasing of product
h. Fabricate and test.

III. DESIGN AND CALCULATIONS OF FABRICATED SYSTEM

A. Design of Shaft

$$\frac{M}{I} = \frac{\sigma_b}{Y} \quad .... (1)$$



Assume Wight of the tire as = 5 KgBearing load equals to 2Kg Ratchet load equals to .5Kg

Another dead load assumed as 2.5Kg extra Perpendiculardistance to be as = 450 mm

Assume as radius of gyration r = 600mm

Bending moment=force*perpendicular distance

= 10*9.81

= 98.1 N

Bending moment= 44145Nmm

Here, we have selected the diameter of the shaft as 25mm so, because we are calculating the max bending moment ofthe shaft weather it fails or not. To the given sustainable loads.) And also, we have done trial & error method by changing the diameter starting from 5, 10 & 15 to see the bending stress in 5 & 10 the value was passing but are actual nearer to the ultimate failure so we choose the diameter as 25 directly here I= **π**/64 *d4_

= **π**/64 *25^4 =19174.75 mm4

Therefore, Y= 25/2 =12.5 half of the diameter

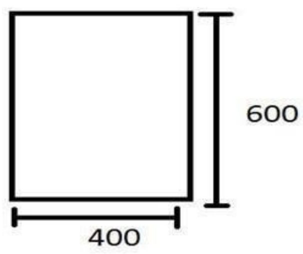
44145 /19174.75 * σ**b**/12.5 = 28.77 N/mm2 Therefore,design is safe.

The allowable shear stress for material is σallow = Syt / fos

- Where Syt = yield stress = 210 MPa = 210 N/mm2
- And fos is factor of safety = 2
- So σallow= 210/2 = 105 MPa = 105 N/mm2
- Comparing above we get,
- σb < σallow i.e
- **28.77<105 N/mm 2**

So, design is safe.

B. Design of Frame



M/I = σb/Y ……. (1)

Total force of all components installed on frame with safety factorForce = 15 Kg

= 15*9.81

= 147.15 N

Perpendicular distance = 600 / 2

= 300mm

Bending moment (M) = force *perpendicular distance

= 147.15*300

Bending moment (M) = 44154 Nmm

25*25*3 mm L-shaped support is used for making frame.

I= bh3/12

= 25(253)/12

Y = yielding area, L cross section 25mm =25/2 =12.5mm Therefore, abovevalue use in equation no(1). 4414532552.08=Sigma12.5

Therefore**,**

I=32552.08 mm4 σ_b=16.95 Nmm^2

Hence, Design is safe.

C. Theoretical Brake Force

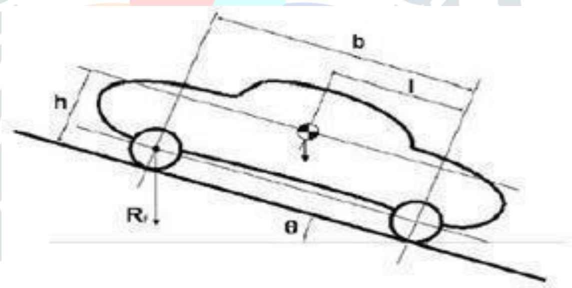


Fig.1 Free body diagram of car on a slope

The torque required to stop the wheel with frame structure is as follows:
Total mass of WHEEL = 5 kg (consider)
Wheel outer diameter = 400 mm = 0.4 m or =600mm = 0.6m **availability in the market** Angular velocity of tilting is 100 rpm = 100/60 rps Amount of Torque required to apply brakes is:

T = Mgr.sinθ + Iα
Where,
Mg = weight of the tilting mechanism. I =
Moment of Inertia I= mk^2, α = angular accelerationof the tilting mechanism
To calculate torque required for braking and force required for that we need to find above values **Radiusof gyration** k^2= $1/3((D/2)^2$

Where D is diameter of wheel in m.,

D. Angular Acceleration

The angular acceleration is,

α = angular velocity / time. $\alpha = \frac{\Delta\omega}{\Delta t}$

Hence in our project we had taken only maximum condition as angular acceleration hence

= ω/t

= 2πN / t

For one minute = 60 sec.

= 2*3.142*100 / 60

= 10.471 rad/sec^2

On substituting the values in equation 1, we get, T=Mg r sinθ + Iα

T= (5*9.81×0.6×sin30) + (0.1499 × 10.471) = 16.284 N-m T=16.284N-m

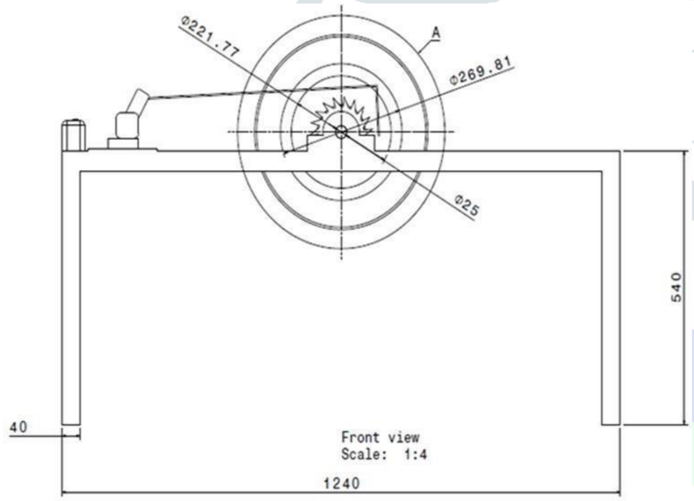
Amount of Force required for braking:

T= F r

16.284 = F*0.6F= 27.14 N

= 27.14 / 9.81

= 2.766 Kg of force required to stop the wheel at given angular velocity, angle of tilt, mass & etc.



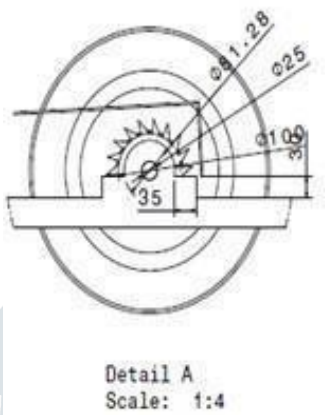


Fig.2 Front View

Fig.3 Detailed View

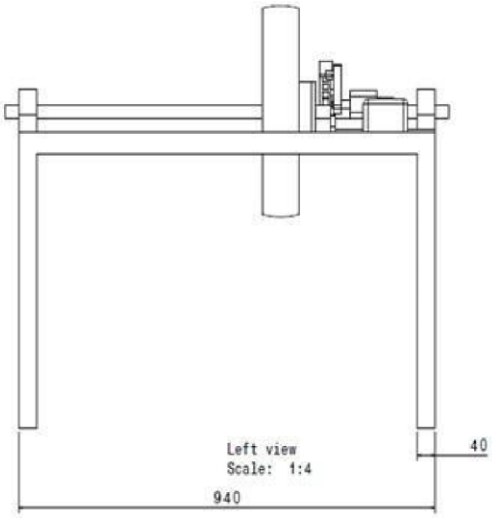


Fig.4 Side View

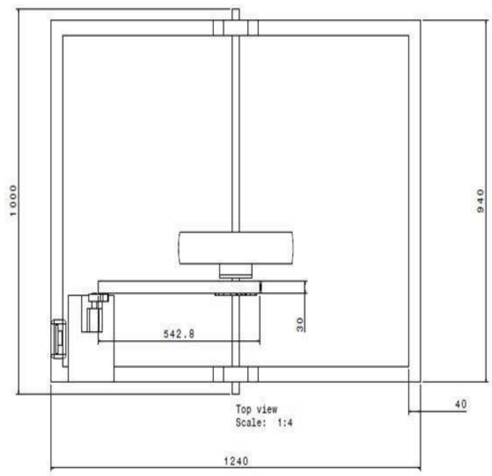


Fig.5 Top View

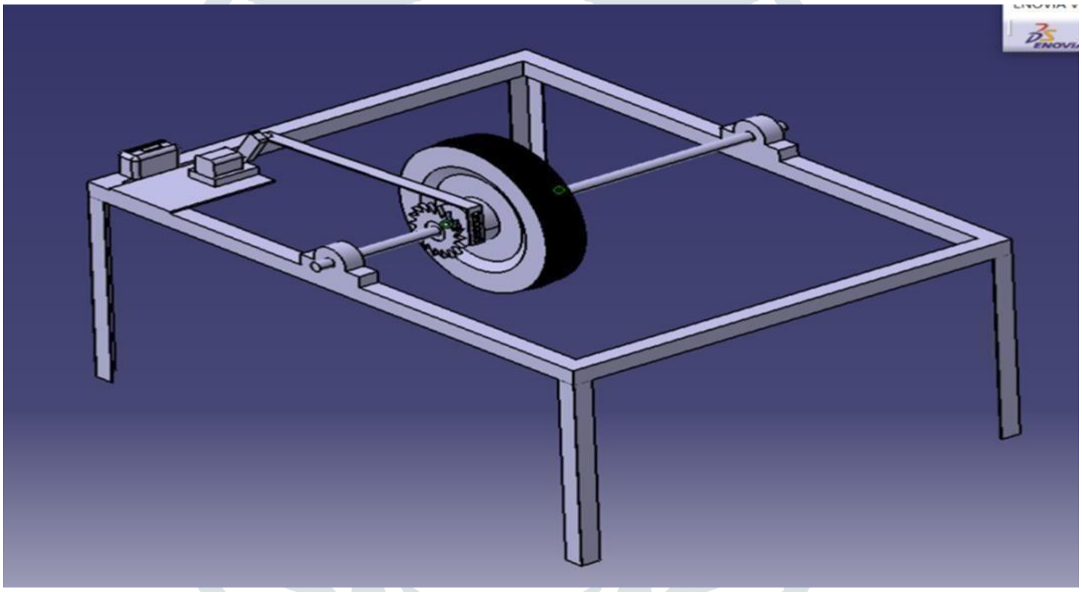


Fig.6 CAD DRAWING

IV. WORKING PRINCIPLE

- The main aim of our project is to provide safety for the passenger to minimize major injuries by preventing accident incident 's. this system is a combination of electronic & mechanical branch which is mechatronics.
- The system consists of a support on which bearings are mounted on either side of the support in which central shaft is installed with a load of wheel tangentially acting upon the shaft.
- Working when the driver puts his seat belt the proximity sensor activates and the brake is released. The braking system is connected to the wiper motor, when the motor rotates in clockwise direction brake is released when it moves in anticlockwise direction brake is applied. the rotation of the motor is controlled via micro controller which is Arduino Uno upon the sensing of wearing & removing of seat belt.

V. CONCLUSION

This work adventured by us can be used as a safety precaution. we have done this project with simple in construction by lower expenses this is one of the advantageous projects. The combination of electronic and mechatronics thereby reducing the chance of death in an accident. This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of knowledge regarding planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution and industries. We are proud that we have completed the work with the limited time successfully. The "DESIGN AND FABRICATION OF SEAT BELT ASSISTED HAND BRAKE RELEASE" is working with satisfactory condition.

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