Automatic Headlight Alignment

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ABSTRACT

The topic of this project is steering controlled (or directional) headlights, that are usually a separate set of headlights fitted to road vehicles beside the usual low beam/high beam headlights and their feature is that they turn with the steering, so that the driver of the vehicle can see the bend, what he is actually turning into. The headlights can be connected to the steering linkage by means of rods or cables, operated hydraulically by the power steering or nowadays electronically adjusted, even controlled by satellite navigation system.

Our project deals with the fabrication of the automatic headlight. As for Indian road transport scenario is concerned, accidents are becoming a day to day cause an attempt has been made in this project to reduce such mishaps. In our project the following operation occurs automatically in the vehicle. They are Automatic head light left and right alignment depends upon the vehicle moves in left and right direction. The head light in steady position for the vehicle in normal condition.

Keywords: *Automatic, Headlight, Alignment, Rack and Pinion.*

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1. INTRODUCTION

Car safety is the avoidance of automobile accidents or the minimization of harmful effects of accidents, in particular as pertaining to human life and health. Special safety features have been built into cars for years, some for the safety of car's occupants only, and some for the safety of others. This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased. Degrees of automation are of two types, viz.

- Full automation.
- Semi automation.

We have pleasure in introducing our new project, which is fully equipped by automatic system. It is a genuine project which is fully equipped and fabricated for automobile vehicles. This forms an integral part of best quality. This product underwent strenuous test in our automobile vehicles and the results are excellent.

A headlamp is a lamp attached to the front of a vehicle to light the road ahead. While it is common for the term headlight to be used interchangeably in informal discussion, headlamp is the term for the device itself, while headlight properly refers to the beam of light produced and distributed by the device.

Headlamp performance has steadily improved throughout the automobile age, spurred by the great disparity between daytime and night-time traffic fatalities: the US National Highway Traffic Safety Administration states that nearly half of all traffic-related fatalities occur in the dark, despite only 25% of traffic travelling during darkness.

Other vehicles, such as trains and aircraft, are required to have headlamps. Bicycle headlamps are often used on bicycles, and are required in some jurisdictions. They can be powered by a battery or a miniature generator.

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1.1 Problem Statement

- DESIGN and DEVELOP the model of vehicle which will have the vehicle safety system of automatic head lamp alignment system for directional headlights which helps for automatic.
- Also to fabricate the model of the same which would able to show the characteristics of systems and working according to need.

1.2 Objectives

- To provide smooth and safety ride at night.
- To provide safe and automatic headlights on turn.
- To provide the nation with an accident free roads with Low Cost Automation Project.
- The head lamp aligns in two directions (Left, right).
- To design and develop the model of showing the system.
- To fabricate the model this will work on this system for the vehicle safety conditions.

1.3 Scope of work

- We've all been there. A dark night, a sharp bend, and a pedestrian wearing dark clothes hiding in the shadows. If only there was some way that the headlights could 'see round the corner', like the driver tries to.
- That's why we are making to turn the headlights as the driver steers the vehicle.
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1.4 Methodology

This system will modify its lightning pattern while travelling turning of road or curvature of road. It will enhance the night visibility for drivers in night time.Figure2.2: Car 1 without Adaptive Front Light Control System and Car 2 with Adaptive Front Light Control System AFS therefore improves driver's visibility during night driving by automatically turning the headlamp in the direction of travel according to steering wheel angle and the distance between two vehicles.

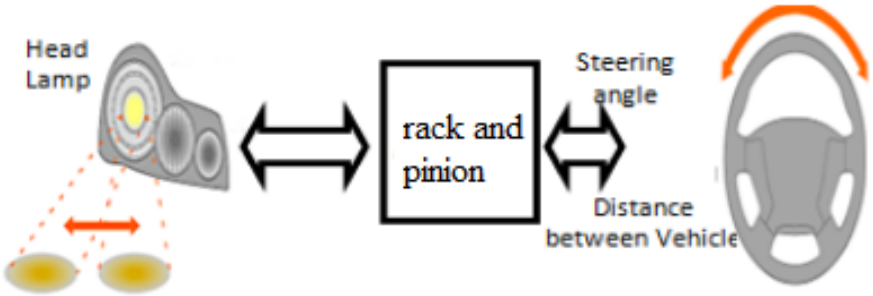

Fig: 1.1. Working Methodology

The aim is to improve visibility for the driver, thereby achieving a significant increase in road safety and driving comfort. The concept of this system is that while turning of the road the headlamp beam turns to follow the direction which was sensed by the steering angle of rack and pinion. Here, we are sensing angle using a POT for demonstration purpose. Good illumination results in a 58% increase in the driver's ability to recognize an obstacle.

2. WORKING

These provide improved lighting for cornering. Some automobiles have their headlamps connected to the steering mechanism so the lights will follow the movement of the front wheels.

At normal condition:-

The rack and pinion steering is in straight line, so that the headlight frame is in straight line. The headlight frame is made up of mild steel pipe materials.

At left side turning time:-

`The rack and pinion steering turn the left direction, so that the head light frame moves in the same left side by using hinges mechanism. Headlight is drawn supplies from the already charged 12 voltage lead-acid battery.

At right side turning time:-

The rack and pinion steering turn the right direction, so that the headlight frame moves in the same right side by using hinges mechanism.

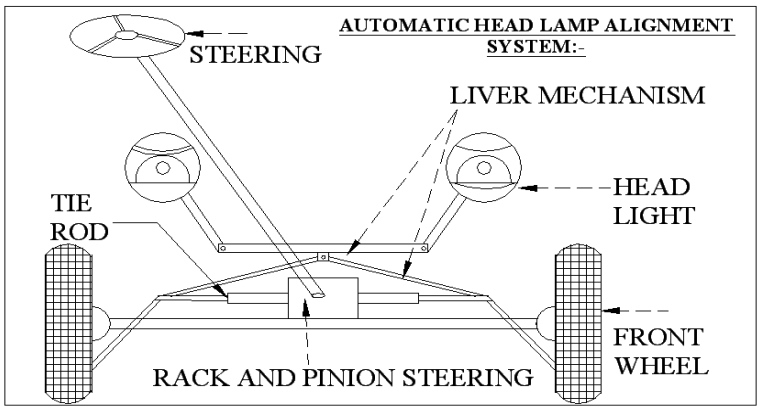

Fig.2.1. Schematic of the system

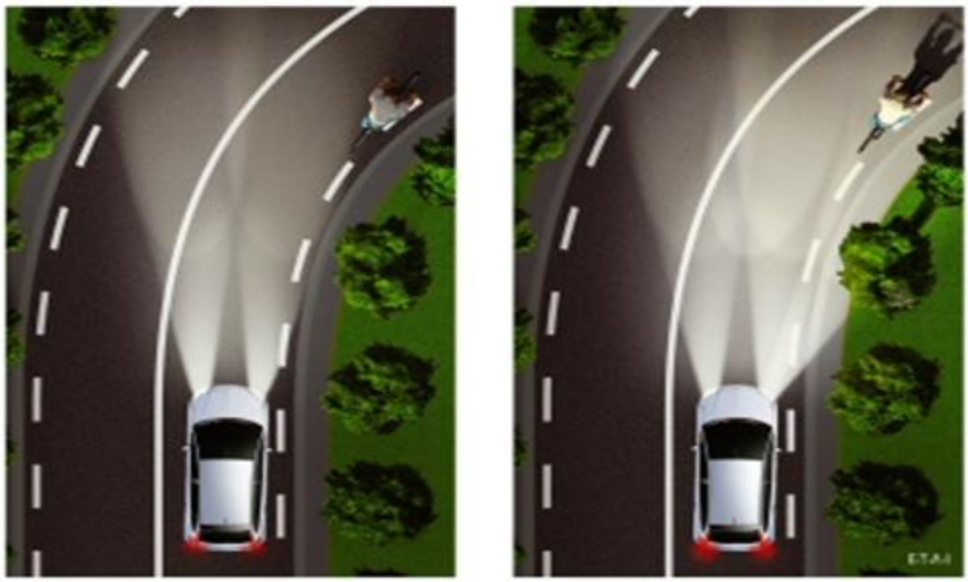

Fig2.2:.effect of adaptive headlights

3. CALCULATIONS

3.1 Rack and Pinion

- $Fn = Ft \tan \theta$ ……(1)

But,

f_t = tangential force (weight of human)=60kg

$f_t = 60 \times 9.81$

$f_t = 588.6$ N

Therefore above f_t value add in equation no (1)

$f_n = 588.6 \times \tan 20^0$

$f_n = 214.23$ N

- $f_r = \frac{f_t}{\cos \theta}$ ……(2)

$f_r = 626.38$ N

- Power (P) = $\frac{\text{Work}}{\text{time}}$ ……(3)

$$P = \frac{\text{Force x displacement}}{\text{time}}$$

$$P = \frac{588.6 \times 0.050}{1}$$

P = 29.43 watt

- $P = \frac{2\pi NT}{60}$ ……(4)

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

$$T = \frac{29.43 \times 60}{2 \times 3.142 \times 30}$$

T = 9.3 N.m.

- $T = f_t \times r$ ……(5)

$$r = \frac{T}{f_t}$$

$$= \frac{9.3}{588.6}$$

r = 0.015 m

r = 15 mm

Therefore, D = 30 mm

- Using Lewis form factor,

$\sigma_t = \frac{f_t \times P_d}{y.b}$ ……(6)

Let,

$P_d = \frac{T}{D}$ ……(7)

$= \frac{18}{30}$

$P_d = 0.6\ mm^{-1}$

Then, above value use in equation no(6)

$\sigma_t = \frac{f_t \times P_d}{y.b}$

$= \frac{588.6 \text{ X } 0.6}{30 \text{ X } 0.308}$

$\sigma_t = 38.22 \text{ N/mm}^2$

- $\sigma_{allow} = \frac{S_{ut}}{fos}$ ……..(8)

  $= \frac{210}{2}$

  $\sigma_{allow} = 105$

  So $\sigma_t << \sigma_{allow}$

So design is safe

- $m = \frac{D}{t}$ ……(9)

  $= \frac{30}{18}$

  m = 1.66

Then the module of pinion = 1.66

Also The module of rack = 1.66

- Pinion dimension,

Outer Dia. (d_0) = 2m + D…….(10)

= 2 x 1.66 + 30

d_0 = 33.32 mm

- Root dia. (d_r) = D – (2m + 2C) ……(11)

  = 30 – (2 x 1.66 + 2 x 0.25)

  d_r = 26.18 mm

- Addendum, A_d = m ……(12)

  = 1.66

- Dedendum, D_d = m + c ……..(13)

  = 1.66 + 0.25

  D_d = 1.91 = 2 mm

- Linear displacement of rack for one rotation of piston,

L = πm x t……..(14)

= π x 1.66 x 18

= 94.44

L= 100 mm

Maximum length of rack is 100 mm.

Width of rack is 10m =16.6mm.

3.2 Design of Frame:

- $\frac{M}{I} = \frac{\sigma b}{Y}$ …….(1)

Bending moment (M) =force *perpendicular distance

=40*600*9.81

Bending moment (M) =235440Nmm

- $I = \frac{b(h^3)}{12}$

$= \frac{35(35^3)}{12}$

I = 125052.08mm4

Therefore above value use in equation no(1).

$$\frac{235440}{125052.08} = \frac{\sigma b}{17.5}$$

Therefore,

σ_b = 32.9Nmm

32.9<105

Hence design is safe.

3.3 Design of shaft:

- $\frac{M}{I} = \frac{\sigma b}{Y}$ …….(1)
- Bending moment = force*perpendicular distance

Bending moment = 5*9.81*450

Bending moment = 22072.5Nmm

- For diameter 15mm,

$I = \frac{\pi}{64} * d^4$

$= \frac{\pi}{64} * 15^4$

I =2483.78 mm^4

Therefore, above value use in equation no (1)

$$\frac{22072.5}{2483.78} = \frac{\sigma b}{7.5}$$

$$\sigma_b = 8.86*7.5$$

$$= 66.64 \text{ N/mm}^2$$

Therefore, design is safe.

4. MANUFACTURING PROCESS

Fig 4: Actual Model

Manufacturing processes are the steps through which raw materials are transformed into a final product. The manufacturing process begins with the creation of the materials from which the design is made. These materials are then modified through manufacturing processes to become the required part. Manufacturing processes can include treating (such as heat treating or coating), machining, or reshaping the material. The manufacturing process also includes tests and checks for quality assurance during or after the manufacturing, and planning the production process prior to manufacturing.

5. ADVANTAGES

- Low Cost Automation Project
- The head lamp aligns in two directions (Left, right).
- Provides Smooth and safety ride in curved roads especially in ghat roads.
- Provides mind free ride for the motorist.
- Provides the nation with accident free roads.
- It requires simple maintenance cares.
- This is the improved safety measure introduced in the automobile.
- Easy to operate.
- Manual power required is less.
- Repairing is easy.
- Replacing parts is easy.
- No need of heavy lubrication

6. CONCLUSION

Today's existing conventional light systems do not provide illumination in the right direction on curve roads. Due to this disadvantage, a need to understand an alternative technology solution. This new system using rack and pinion mechanism and lever mechanism this newly proposed Adaptive front lighting system helps to improve driver's visibility at night time hence achieving enhance safety and avoid accidents. The future work mainly concentrates on to invent a comprehensive headlight alignment system which can be suitable for complex road conditions including related to this paper.

7. NOMENCLATURE

f_t = tangential force

f_n = normal force

f_r = resultant force

θ = pressure angle=20^0

T = torque

P = power

r = radius

D = diameter

P_d = diametrical pitch

m = module

A_d = addendum

D_d = dedendum

t = number of teeth on pinion

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