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Design and Development of Smart Headlamps for Static Frame Two-Wheelers for Adaptive Turning

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***Abstract*: In the traditional way steering handle of a two wheelers, the headlamps were mounted on the handle making it heavier while turning and since it is more prone to vibrations, the light have a shorter life. But in a newer designs the headlamps have been attached to the chassis of the vehicle making it less prone to vibration and aesthetically better. But this also raises a serious problem of inflexible focus of light pointing straight even at the corner which can cause confusion and delay in the response time of the rider. Thereby adjusting the light beam according to the turn can be thought of as possible solution to the problem above. One possible way of this is achieved by observing the roll of the bike and making the necessary correction in the light so that the light scattering in the unwanted region can be used to illuminate the pathways in accordance with the turn. But recently a new trend of using more two light bulbs is observed but rather than improving the illuminated area it will affect by the battery power consumption.**

***Keywords*: Smart Headlamps, Adjectives Light beams, Adjustable Focus, Tuning beams, Static head lamps**

1. Introduction

In the night, steering any engine propelled vehicle needs a mandatory component i.e. headlamps as one cannot get dependent of streetlight to light up the whole pathways. A two-wheeler such as bike scooters, moppets etc. have been designed with a headlamp at the handle so that it can illuminate the way in the direction it is turned. But with the advancement in manufacturing technology and the ease in creation of newer and newer designs, viability of designs which are both economically cheap and aesthetically better have taken over the traditional ways and designs. The designs of steering handle of new 2 wheelers have significantly changed too. Unlike the traditional handles, the handle is now mounted on the chassis as a single unit. These designs can be seen in bike models like YAHMHA FAZER, FZEE, STUNNER, R15 etc. which has made the handle lighter so that it can be firmly gripped at uneven roads and even help in making sharper turns.

But with this advancement in the design, problems relating to focusing of light along the turn have been greatly influenced. Now while turning the bike, the still points in the same direction i.e. the light point tangential to the turning radius, which can cause problem for the rider by making a situation of confounded and thus static frame can affect the rider judgement about the turn to be made causing delay in the response time. The physics relating to the turning of a two wheeler is quite different than compared to 4 wheelers. In any two wheelers while turning the concept of GYROSCPIC PRESSION comes into picture. Hence whenever the rider applies a force to tilt the two wheeler's handle, the front wheel experience a shift in the direction of angular momentum. Since the torque follows the direction of momentum a force actually bend the rider. We can use this property in determining which side actually is the turning side of the rider. And the reflectors can be turned.

As discussed another way of solving the problem is by adding another light bulb which will cause unnecessary pressure on the battery life and charge stored. The charge will be used at a much faster rate thus causing problems in other battery related instruments like the indicators, tail light and others, but this method is currently in use. Hence this is not an optimum design.

A common objection may rise that since the whole bike is turning, in essence the frame of reference is almost tilted and how can we determine the tilting. Gyroscope sensor with accelerometer will help in determining the roll thereby giving us the value with which the reflectors should be turned. The frequency of the lowest pulse is similar to the frequency of the microcontroller being used. Even all these instrumentation can be placed in a box which is attached to the frame of the bike.

2. Problem statement

The problem for the major road accidents at night time is the limitation on visibility region. Due to lack of street lights outside the urban areas, the driver is unable to focus on the area other than the area in visible laminated region of the headlights. While turning, the headlight point tangent to the curving road and since the head is inflexible therefore the whole light creates a blind spot on the road that is there is a section of the road where there is a black out and all the light that is present is being wasted. This major drawback actually increaser the response time of the driver making him more vulnerable to the accidents.

Moreover, this will cause a problem of ambiguous state of mind for the traditional bike riders. And the problem with the newer design is that an additional bulb light will cause more dissipation of heat and thereby casuing excessive stress on the limited size batteries. This sudden charging and discharging will obviously effect the life of the battery making it non-usable quite soon and reducing its life.

3. Objective

The main agenda is to develop an active adaptive system for night time driving for two wheelers. Following are the main objectives:

- To increase the visible region on the corners
- Reflect the excessive light to the dark area
- Increasing the time for the rider to respond to any obstacle
- Other objectives of the work include:
  a. Improving the design glitch relating to headlamps in modern 2 wheelers
  b. With the addition of the above features the cost effectiveness with the new designed steering handles of the bike can be implemented.

4. Working

As soon as the driver initiates a turn, he tries to apply toque in the direction of the turn. This torque causes the spinning axis of the wheels to precis and therefore tilting the bike. This angle of tilt is further read by the gyroscopic sensor. The value of the angle is fed to the system which manipulated the direction and orients each reflector accordingly. With this new orientation of the reflectors, the light now orients to the direction of the turn and following the drivers steer.

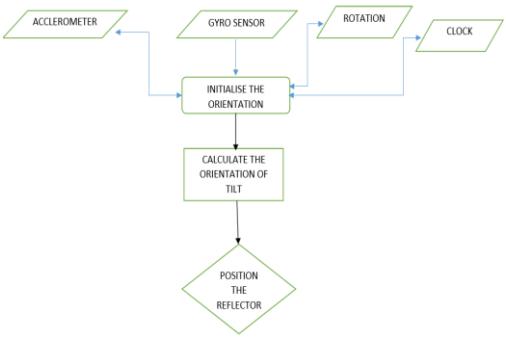

Fig. 1. Working flowchart of our proposed model

5. Calculation

Gyroscopic couple vector = change in angular momentum per unit time

= moment of inertia of the wheel * rotation per second of wheel * precession

Gyroscopic couple vector= $I * \omega * \omega_p$

ω_p = Gyroscopic couple vector /($I * \omega_p$)

$d\theta_p/dt$=Gyroscopic couple vector /($I * \omega_p$)

$d\theta_p = \int$ {Gyroscopic couple vector /($I * \omega_p$) } dt

With the known angle of tilt, servo motor will be feed so that the reflectors can be oriented according to the direction of the turn.

6. Proposed design

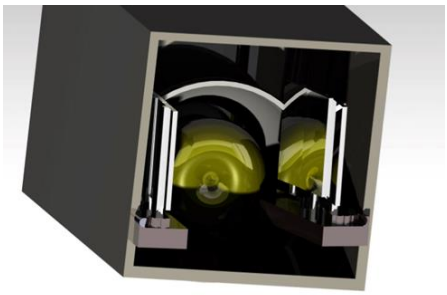

Fig. 2. Proposed design for the headlamps

7. Result

The graph presented below showcases the result obtained. With a controller with a better clock speed a better oriented data can be obtained. Therefore, with the small change in roll of bike the program calculates and orients the whole reflectors to a new orientation. This actually diverts light from horizon to the spot where there is low or absolute no light, thereby giving the driver more time to respond and thus taking quick decision. It can also be thought as road safety device and thus making two wheelers more safer. Some data points collected using actual experiments are.

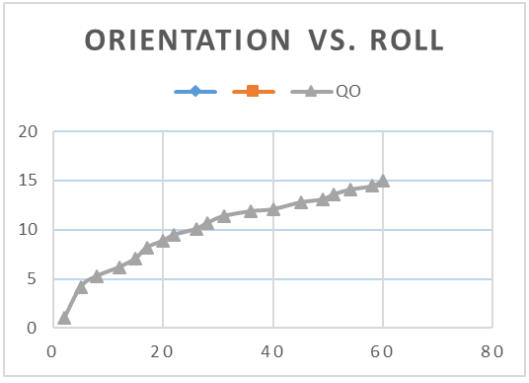

Fig. 3. Graph representing orientation vs. roll

8. Conclusion

In this project design and modelling of smart headlamps has been done. The main goal of our project was to widen the range of view for a static frame bike which can only point in same direction while turning. Another aim was to minimize the overall cost of the model which was also achieved. Our work started with identification of problem with static frame bikes

and then the designing of model and procurement of required material. CATIA software was used for designing whereas PROTEUS 8.1 and ARDUINO were used for its coding and simulation. Finally, the fabrication of model of smart lamps was done at the workshop. The model is working satisfactorily. This concept was new and the data available was also limited for two wheelers. There are some future modifications possible. The prototype suffers from a few limitations which can be taken care of as listed below:

a. The sensitivity of the sensor can be introduced.
b. A failure system that comes in play when battery dies
c. Increasing the rate of charge storage of battery
d. The material of the prototype can be replaced with multiple glass reflectors so as prepare quality turning experience.

The smart headlamps was successfully developed and assembled. The aim to fabricate a simple model to show how the system works was successfully achieved. If our proposed project comes to application in the industry, cornering lights for 2 wheelers could become practically useful and start to appear in almost all fuel powered two wheelers after make some improvement.

References

[1] Boebel, Doris & Rosenhahn, Ernst-Olaf & Igoe, Denis, "Cornering Lamps and Static Bend Lighting - Performance Aspects and Technical Comparison in AFS-Systems," 2003.
[2] Adamsson, Mathias & Laike, Thorbjörn & Morita, Takeshi. (2018). Comparison of Static and Ambulatory Measurements of Illuminance and Spectral Composition That Can Be Used for Assessing Light Exposure in Real Working Environments. LEUKOS. 15. 1-14.
[3] Ravichandran, (2016). Intelligent Public Lighting System. 9. 201-204.
[4] Embedded Robotics BY Thomas Braunl, Springer publication, pp. 27-29.
[5] Arduino for Beginners Essential Skills Every Maker Needs by John Baichtal que publication.