EMBEDDED C AND LINUX (ECE4004)

PROJECT TITLE: ADAPTIVE HEADLIGHTS SYSTEM

LITERATURE SURVEY

The highest fatal road accidents occur in curved roads. In most cases, late recognition of an object or vehicle is the reason for accidents. Four-wheeler driving always carries a lot of danger. Many things are related to vehicles and driving atmosphere like road texture, darkness, visibility, track unevenness. The conventional headlight fails to give the visibility of the upcoming objects at the right time. When the road curves or turns, the corner on time when the vehicle turns, thereby creating a dead angle of illumination and such lack of visibility poses danger in driving at night or in darkness. Therefore, it is highly desirable to invent a device to solve this problem and such a device is of high utility. Our project tends to improve the visibility of such objects of road or path of turning.

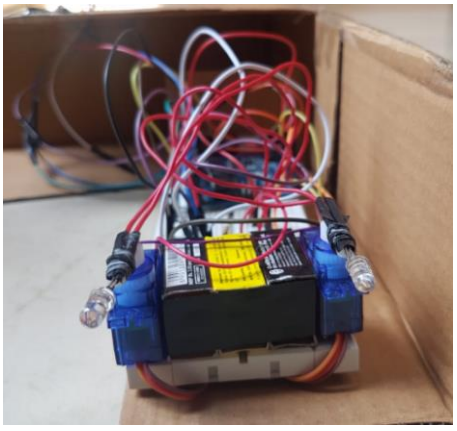
These types of headlights appeared on production cars in the 1920s along with the turn of the steering the adaptation will be in the form of light intensity for headlights and moisture sensing for side indicator lights. Adaptive Headlights debuted in the Czech - built Tatra 77.

At the present time, we mainly have 2 types of mechanisms/models - Gear system and Sensor-based system, each having its own advantages. Implementation of the sensor-based

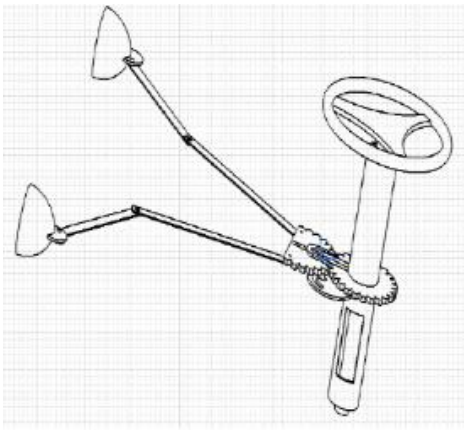
system is more prominent than the gear-based system. The sensor-based system has 2 servo motors which have been attached to the headlights so that the headlights can move according to the steering direction. A gyro sensor has been placed on the steering wheel to detect the direction of the turn and based on the values obtained, we calibrate the servo motor. All these components have been interfaced with a micro-controller (Arduino UNO) and this whole system could be placed at the hood or somewhere closer to the headlights.

There are different variations to the sensor-based system like adding a LDR to the system for the automatic switching of the headlights, fitting an extra filament in the headlight bulb and adjusting it in such a way the dazzling effect from the light beam decreases and adding a sensor on the hood of the vehicle to detect any pedestrian crossing ahead of the driver and to alert both the pedestrian and driver.

Valeo has developed a Adaptative Driving Beam (ADB) system that uses a camera to detect the presence of other vehicles. The headlamps remain in the main beam position and progressively lower the beam as an oncoming vehicle approaches, to avoid glare. The function also considers the rear lamps of vehicles driving in the same lane. In an even more innovative development, the camera and position captors will detect the road's gradient and adapt the beam height accordingly. Those functions are grouped together under the name BEAMATIC. Also developed the Xenon or L.E.D. module can swivel in every direction and adapt the light beam according to the vehicle speed and the weather conditions to improve driver's comfort and safety.



In the Gear-based system, As the steering wheel rotates, the gear mounted on steering column also rotates and the rotation is further transferred to the semicircular gear due to meshing of semicircular gear with steering column gear. At the initial stage, the headlight is at mean position and the pivot point of the gears moves in the slotted guide plate. At the mean position the pin is at the midpoint of the slot and with the movement of headlight towards extreme left or right position, the pin also transverses the distance away from the mean position of pin in the slot. Now when the semicircular gear rotated the linkage attached to the semicircular spur gear also rotates and it helps to transmit the motion to the headlight. If the steering wheel is rotated clockwise then semicircular gear rotate in anticlockwise direction. Then the left side linkage will pull the headlight, and this will result in the rotation of headlight in leftward in the same way the headlight is rotate in the rightward direction.



PERFORMANCE ANALYSIS

The corporate companies who have applied the concept in their automobile models have great performance when compared to the prototypes introduced in the other research papers/ documents. Big firms of the automobile industry like Nissan, BMW, Mazda have the adaptive front headlight systems implemented in their vehicles.

Audi - The adaptive lighting system is available for the xenon plus headlights that further strengthens to the security of nighttime driving.

BMW - It is a standard feature present in most models.

The adaptive headlamp system of (Amity School of Engineering Technology, New Delhi) and (Y.M.C.A. University of Science & Technology, Faridabad (121006), May 2014) use gear systems to achieve the steering information instead of sensors. This requires extra effort in designing the gear system and the sensitivity cannot be changed using some software platform. In the case of sensors, the calibration of the headlamps and the steering can be adjusted by making changes in the code. In real-time implementation, multiple sensors, as well as gears, are used to implement the system.

COST ANALYSIS

Cost analysis of our project:

S. No	Component	Quantity	Cost (INR)
1.	Arduino Uno + USB cable	1	440
2.	GY-521	1	125
3.	LEDs and Jumper wires	2+	100
4.	Breadboard	1	60
TOTAL			**725**

Our project prototype is economically feasible and costs about 725/- (INR).

In comparison with the other models mentioned above, the prototype is cost -effective. The system with gears involved would cost about the same but the mechanical support for the system would cost us a lot more than the electronic system. If any of the sensors used in the prototype are damaged, it is inexpensive to replace it and does not need assistance. But for a gear-based system, if not maintained right could really affect the whole system and cost us more to fix it.

ACCURACY

The sensor system would give better accuracy than the gear system. This is the reason why companies prefer using multiple sensors in the real-time implementation of the concept in their automobile models. Calibration of the sensors used in the sensor-based system is much easier compared to the calibration of the gear system.

Some models have implemented using micro-controllers instead of embedded boards. This would make them cost effective and increase their performance since the other components can be modified according to the specific requirement.

Some models have an additional feature which controls the beam of the headlamps (high beam or low beam) based on the vehicle approaching from the front and hence helps the other driver ride conveniently with having any extra light falling into the eyes directly.

REFERENCES

1. https://iarjset.com/upload/2016/april-16/IARJSET%2011.pdf
2. https://www.scribd.com/doc/214640363/Steering-Controled-Headlights-Project-Report
3. https://www.engineersgarage.com/mygarage/adaptive-lighting-system
4. https://www.nissan-global.com/EN/TECHNOLOGY/OVERVIEW/afs.html#starred/_blank
5. https://www.mazda.com/en/innovation/technology/safety/active_safety/afs/#starred/_blank
6. https://www.researchgate.net/publication/294260137_Development_of_an_Adaptive_Steering_Controlled_Headlight_for_Low_Cost_Vehicles
7. http://www.iosrjournals.org/iosr-jmce/papers/NCRIME-2018/Volume-1/6.%2028-32.pdf
8. https://www.valeoservice.co.uk/en-uk/passenger-car/lighting-systems/headlamps