

SREE VISVESVARAYA INSTITUTE OF
TECHNOLOGY & SCIENCE

A TECHNICAL SEMINAR ON
NIGHT VISION TECHNOLOGY IN
AUTOMOBILES

BY

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Abstract

Safety and security of life are the two most booming words in the field of transport and manufacturing. The world has emerged from being a just simple form of day to day life to being an era of mean and daring machines.

Thus the safety of the people both inside and outside the vehicle is of prime concern in the car manufacturing industry and scientists are working day in and day out to ensure more and more complex forms of security for the human kind.

After dark, your chances of being in a fatal vehicle crash go up sharply, though the traffic is way down. Inadequate illumination is one of the major factors in all the car crashes that occur between midnight and 6 a.m. Headlights provide about 50 meters of visibility on a dark road, but it takes nearly 110 meters to come

to a full stop from 100 km/hr. At that speed, you may not respond fast enough to an unexpected event, simply because the bright spot provided by your headlights doesn't give you enough time. Thus emerged the night vision systems that use infrared sensors to let driver see as much as 3 or 4 times farther ahead and help them quickly distinguish among objects.

Introduction

The streets of yesterday has turned to be monstrous night mare for the public with demon like vehicle that swift past the roads at very high speeds and the case gets worst in the night with drunken drivers ruling the road with high stake speeds.

The reckless accidents that occur on roads during night times mainly owe to the poor visibility and make the drivers rather than driving ahead, predict their way ahead. But this is not just the case

of drunken drivers but also sensible drivers who find very bad visibility during the wee hours of morning or the odd evenings

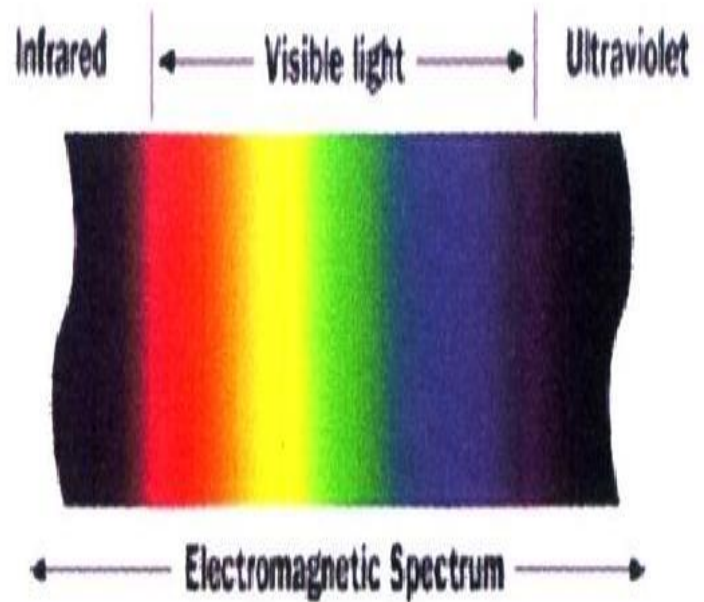
It is a system to increase a vehicle drivers visibility in darkness or poor weather beyond the reach of vehicles headlights.

Thus comes the use of night vision systems which uses infra-red sensors or headlights to provide a clear view of the road ahead and in the coming sections we shall discuss about the detailed working of the night vision systems in automobiles.

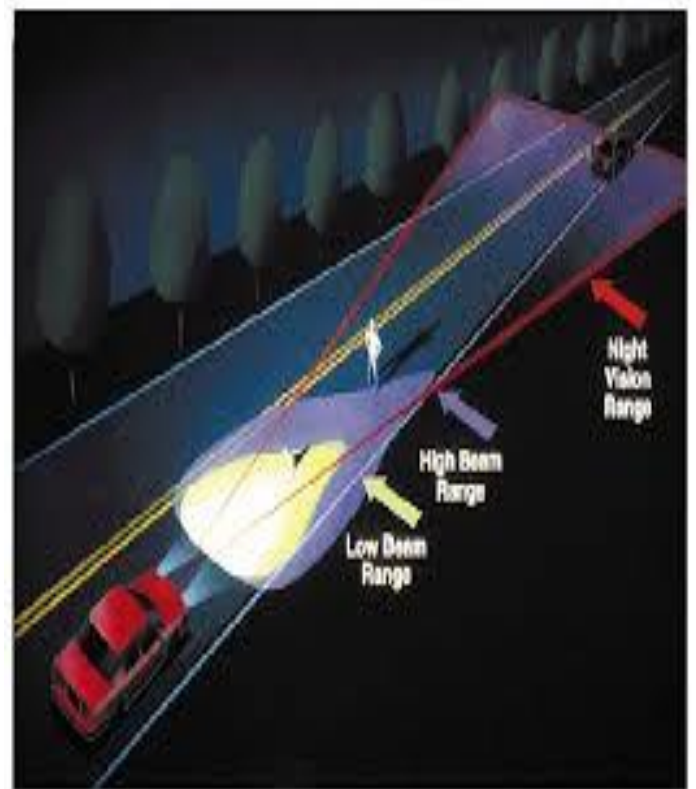


Electromagnetic Spectrum

Before going into the night vision systems it is necessary to understand something about light and the electromagnetic spectrum. Humans are visible only to the rays falling under the visible region of electromagnetic spectrum and are invisible to both the infra-red as well as the ultra violet region of the electromagnetic spectrum.



But night vision technology makes it possible for the humans to view the rays falling in the infra-red region of the electromagnetic spectrum, that is generally the night vision systems used in automobiles captures the infra-red image of distant obstacles on road as every object emits infra-red rays (heat rays) even during night. This image is viewed in a screen and the driver can thus apply the brakes as required



There are two types of Night vision system:

1. Active System
2. Passive System

We mostly use Active systems in Automobiles

Active Systems :

It uses Infrared light (Invisible to human eye) source built into the car to illuminate the road ahead

This type enables long ranges (250m) and high performance in rain and snow.

Advantages :

Higher resolution image, superior picture of inanimate objects ,works better in warmer conditions

Disadvantages:

Does not work in fog or rain ,lower contrast for animals, shorter range of 150-200 meters.

Passive System :

It do not use infrared light source instead they capture thermal radiation already emitted by the object, using a thermo- graphic camera..

Advantages :

Greater range of about 300 meters, higher contrast for living objects

Disadvantages:

Grainy , lower resolution images, works poor in warmer weather conditions, require larger and costly sensors.

Working Of Night Vision Systems In Cars

Automotive night vision comes into two flavors: near and far infrared (IR). The near infrared technology detects the portion of the IR band nearest to visible light. But, the near IR detector needs an assist. Special bulbs mounted next to the headlights are aimed straight ahead like a car's high beams, but they don't blind other drivers because the human eye is insensitive to the infrared light. The NIR system illuminates the surroundings with infrared light in the wavelength of 800 to 900 nm. The infrared reflection of objects is captured and converted to a digital signal by a Charge Coupled Device (CCD). The digital signal from the CCD is routed to the image processor that translates it into a format that can be viewed into a black and white head-up display beamed onto the wind-shield.

The far infrared technology detects energy farther up the infrared band that is emitted by objects as heat. This far IR night vision is also called passive, because no special light source is required. The special camera these systems use - essentially a phased array of IR detector elements analogous to the pixels in an ordinary digital camera - creates a temperature pattern called a thermo gram, which is refreshed 30 times a second. The heat from a pedestrian or an animal is much greater than the heat coming to the camera from its surroundings. A signal processor translates the thermo gram data to an image suitable for display on a monitor. It has been found out that neither of the technologies has a clear advantage.

But, not everyone thinks night vision in cars makes sense. The biggest problem with night vision is that these systems demand that

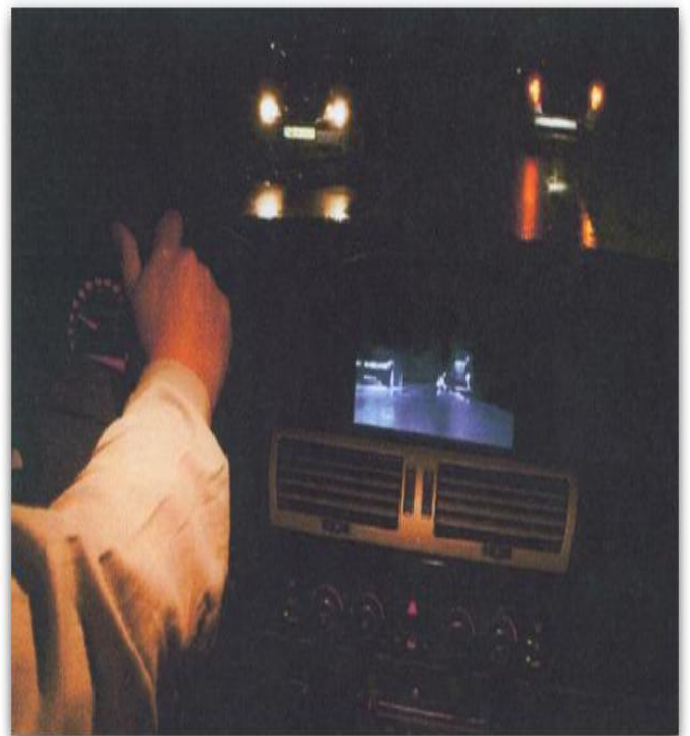
the driver take his/her focus from the road, which is not a good idea, and drivers will just increase their speed, believing themselves to be less at risk, so to avoid this problem the driver is given an automatic warning of the approaching object and thus he doesn't have to look every time on the monitor to check for vehicles and he can completely concentrate on the road while driving. Effective algorithms are required in order to send a warning to the driver fast enough if a pedestrian is detected.

LCD Monitor Used By NVDS

The night vision image does not have color information, and hence monochromatic displays are sufficient. A green phosphor (P22) LCD display is generally used as the human eye is most sensitive to the color green in this wave length, which falls in the middle of the visible light spectrum. Viewing images in green background also doesn't

create much strain to the human eye.

The latest generation of NVD uses a green yellow Phosphor (P43) LCD displays, and gives the operator a much more comfortable viewing experience. Current developments have also created a gray scale or black & white Phosphor, where the images can be viewed in black and white.



What does the system use ?

Dual camera

Amplifier

On board display

Motion detection sensor

Sensors Used

Vehicle Speed Sensor

Daylight Sensor

Night Vision Sensor

Automobiles using this Technology

- Rolls Royce Wraith
- Mercedes Benz maybach , S-Class
- Cadillac CT6
- BMW 7-Series
- Audi A6

Conclusion

To put it in a nut shell it has become the need of the hour to have these kinds of hybrid safety systems on the latest automobiles that could save the lives of many. All the automobile giants should divert their R&D work towards such innovative technologies and make this world a safer world to live in. Many such ideas are yet to come and it is the duty of young budding engineers to think innovatively and work upon developing such techniques one of which being the night vision sensors used in cars and other automobiles that are proving to be a great success in the west and this should be implemented immediately on the Indian terrain and reduce the catastrophic incidents that occur on the roads especially during the night times. In the recent past small scale developments have come into play and the world is looking forward for such creations to come into play.

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