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Night Vision Assistance for Safe Driving

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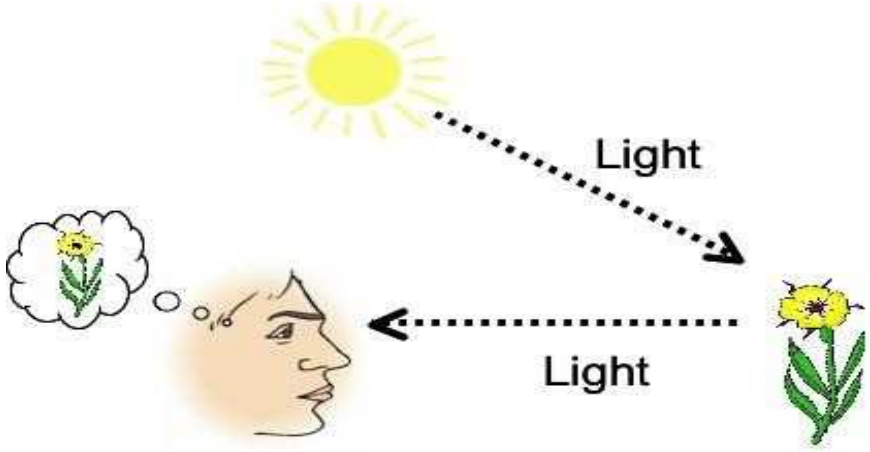
Abstract - Night vision technology, by definition, literally allows one to see in the dark. Originally developed for military use, it has provided the United States with a strategic military advantage, the value of which can be measured in lives. Federal and state agencies now routinely utilize the technology for site security, surveillance as well as search and rescue. Night vision equipment has evolved from bulky optical instruments in light weight goggles through the advancement of image intensification technology. The first thing you probably think of when you see the words night vision is a spy or action movie you've seen, in which someone straps on a pair of night-vision goggles to find someone else in a dark building on a moonless night. And you may have wondered "Do those things really work, Can you actually see in the dark. The answer is most definitely yes. With the proper night-vision equipment, you can see a person standing over 200 yards (183 m) away on a moonless, cloudy night! Night vision can work in two very different ways, depending on the technology used.

keywords - Image Processing, Night vision technology, Safe Driving security, surveillance.

I. INTRODUCTION

In order to understand night vision, it is important to understand something about light. The amount of energy in a light wave is related to its wavelength: Shorter wavelengths have higher energy. Of visible light, violet has the most energy, and red has the least. Just next to the visible light spectrum is the infrared spectrum. The electromagnetic spectrum consists of all the different wavelengths of electromagnetic radiation, including light, radio waves, and X-rays. We name regions of the spectrum rather arbitrarily, but the names give us a general sense of the energy of the radiation; for example, ultraviolet light has shorter wavelengths than radio light. The only region in the entire electromagnetic spectrum that our eyes are sensitive to is the visible region The visual ability of humans and other animals is the result of the complex interaction of light, eyes and brain. We are able to see because light from an object can move through space and reach our eyes. Once light reaches our eyes, signals are sent to our brain, and our brain deciphers the information in order to detect the appearance, location and movement of the objects we are sighting at. The visible light from sun or any light



source is incident on different objects surrounding us. The reflected visible light from the objects enters our eyes and we can perceive the objects.

We can't see objects in dark because of the absence of the visible light. There is no visible light getting reflected from objects surrounding us, so we cannot perceive anything.
There may not be visible light getting reflected from different objects. But there is a possibility of infrared rays emanating from objects which can be used to produce vision in complete dark. This is the back bone of night vision devices. Night vision devices makes use of these infrared rays emitting from different objects to produce vision in dark.

II. OVERVIEW OF OUR NIGHT VISION ASSIST

This near infrared source emits near infrared rays that is it emits light rays with wavelengths around 960nm.As discussed in section 1.7 that we cannot see infrared rays, we can make this infrared source as intense as possible to illuminate long distances. This is not going to obstruct the drivers of the vehicles coming in opposite direction. This is because we cannot perceive infrared rays.

These infrared rays are incident on the vehicles or people in the surrounding area and gets reflected from those vehicles. These reflected infrared rays are needed to be captured. We cannot use ordinary camera to capture these infrared rays. Since camera's do not capture infrared rays. So, we need a special camera called Infrared camera to capture those infrared rays.

These reflected infrared rays are captured by infrared camera. The captured images are processed further. We are going to highlight anything that obstructs the driver. This includes people crossing roads, animals moving on roads. We are going to highlight these things with the red mark. Besides highlighting with the red mark, this system also gives a beep sound when the above mentioned things happen. This is used to alert the driver to take necessary action. These processed images are displayed in the display unit placed inside the car. In this way we are increasing the perception of the driver even in complete dark.

Fig. 1. Two persons standing on road can be seen clearly on display unit placed inside the car

Fig. 2. Pedestrian highlighted by red mark as seen on display unit .

III. PROPOSED SYSTEM AND BLOCK DIAGRAM

The probability for an accident at night is by the factor 4 to 5 higher than at daytime. Accident statistics show, that night vision driver assistance systems have a high potential for reducing accidents and fatalities by collision avoidance and collision mitigation means. Night Vision Systems based on Near-Infrared Radiation (NIR) or Far-Infrared Radiation (FIR) can be used to enhance driver's perception at night. The system must be an optimal vision aid allowing him to drive like cruising with high beam on without blinding oncoming traffic.

Special emphasis has to be put on a careful design of the Human Machine Interface (HMI) to avoid distraction by the system. For a quick and distraction-free reading of the image presented to the driver the picture must allow a quick interpretation of the presented information by the driver. The display must be positioned in an ergonomically favorable position in the vicinity of the primary field of vision of the driver without distracting him longer than necessary from the traffic.

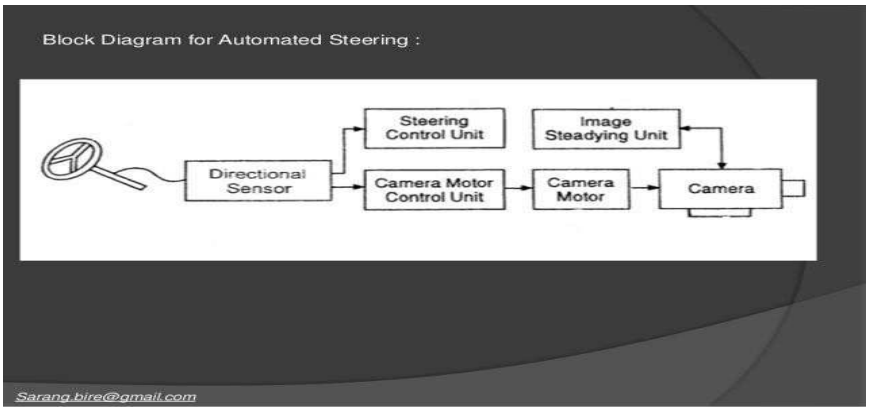


Fig. 3. Proposed block diagram for night vision assistance

IV. IMAGE PROCESSING

Image acquisition is the first process shown in Fig. Note that acquisition could be as simple as being given an image that is already in digital form. Generally, the image acquisition stage involves pre processing, such as scaling.Image enhancement is among the simplest and most appealing areas of digital image processing. Basically, the idea behind enhancement techniques is to bring out detail that is obscured, or simply to highlight certain features of interest in an image. A familiar example of enhancement is when we increase the contrast of an image because "it looks better." It is important to keep in mind that enhancement is a very subjective area of image processing.

Image restoration is an area that also deals with improving the appearance of an image. However, unlike enhancement, which is subjective, image restoration is objective, in the sense that restoration techniques tend to be based on mathematical or probabilistic models of image degradation. Enhancement, on the other hand, is based on human subjective preferences regarding what constitutes a "good" enhancement result.

Colour image processing is an area that has been gaining in importance because of the significant increase in the use of digital images over the Internet. Wavelets are the foundation for representing images in various degrees of resolution. Compression, as the name implies, deals with techniques for reducing the storage required to save an image, or the bandwidth required to transmit it. Although storage technology has improved significantly over the past decade, the same cannot be said for transmission capacity. This is true particularly in uses of the Internet, which are characterized by significant pictorial content.

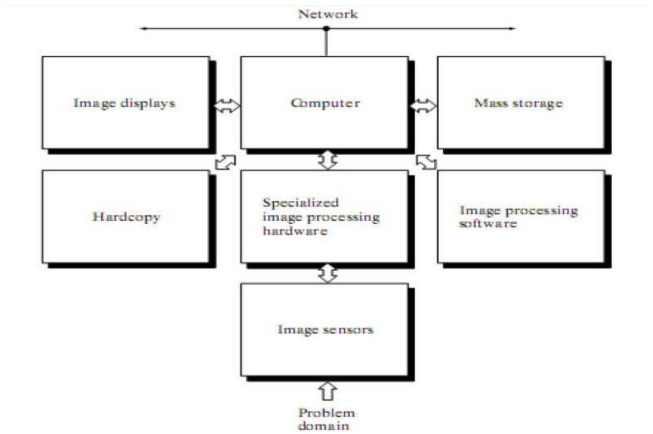


Fig. 4. Image processing system

V. CONCLUSIONS AND FUTURE SCOPE

A comparison of the technology and of the aspects of image representation and image processing shows that the NIR-system is superior to the FIR-system on some criteria. The NIR technology will enjoy at a long term basis a massive cost benefit due to the meanwhile low price of the video camera and due to its usage by several applications at a time. Furthermore, research has shown that although the wider reach of the FIR system represents an increase in comfort, this

does not automatically translate into any considerable plus in term of safety and acceptance. Current first generation night vision systems presenting live images in the primary field of the driver's view can be realized with Head-up- and Head-down displays. Investigations have shown that the latter produce less distraction to the driver while reading the display than HUDs. On a longer term basis these systems will be substituted by systems based on object detection. These second generation systems provide warnings instead of images to the driver, and will also be used e.g. for lane departure warning or obstacle collision warning, which will require new ideas for human machine interfaces. Further on, object detection will be the basis for controlling actuators for lane keeping functions and collision mitigation and collision avoidance functions at night. With the increase of embedded micro-controller performance and the ongoing development of software algorithms, functions based on object classification will be able to control special safety features. The evolution of night vision functions is a process which depends on one hand on the development of hardware and software technologies, on the other hand on the acceptance of each driver and the overall contribution to the communities in reducing fatalities.

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