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A WIDE-DYNAMIC-RANGE CMOS SENSOR WITH GATING FOR MULTIPLE APPLICATIONS

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Abstract— **The stereo vision ability is the basis that allows the brain to calculate qualitative depth information of the observed scene. The acquisition, storage, processing and comparison of such a huge amount of information require enormous computational power - with which nature fortunately provides us. Therefore, for a technical implementation, one should resort to other simpler measurement principles. The qualitative distance estimates of such knowledge-based passive vision systems can be replaced by accurate range measurements. This is because the basic principle of stereo vision is the extraction of characteristic contrast-related features within the observed scene and the comparison of their position within the two images. High resolution can only be achieved with a relatively large triangulation base and hence large camera systems. Powerful high functionality pixels demodulation of pixels extracts the target's distance and reflectivity from the received optical signal. This extracted information is modulated into the active optical signal during the time of propagation of the light (or time of flight) through the observed scene. Each pixel works like an individual high-precision stopwatch. Both devices have been integrated in separate range cameras working with modulated LED illumination and covering a distance range of 7.5 up to 15 meters. For non-cooperative diffusely reflecting targets these cameras achieve centimeter accuracy. The validity of this equation is confirmed by computer simulations and devices. Thus, prediction can be done on the range accuracy for given integration time, optical power, target distance and reflectance.**

Keywords— **WDR CMOS image sensors, gated vision, global shutter, night vision, wide dynamic range, TFT LCD, ARM11.**

I. INTRODUCTION

Now-a-days safety driving is a difficult to maintain by manually. Now-a-days safety driving is a difficult to maintain by manually. Infrared sensitive camera based night vision systems can enhance the visibility of objects emitting or reflecting heat waves, making visibility comparable to high beam conditions.

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The main objective of this paper is to reduce accidents and to provide safety to the life of the people & vehicle. People drive during the night to far places in order to reach the destination but some distractions may disturb their concentrations. So during that time to avoid the life damages as well to avoid accidents, we go for this paper. So inbuilt sensors help to detect the vehicle or the object or the persons that are within 7.5 to 15 meter range. The image is sensed and processed. The sensor must be capable to capture the object during night time as well as the day time. So this will be helpful to persons those who cannot able to view an object in some distance. We are using the various new upcoming trends and softwares to capture and process the object.

II. PROPOSED SYSTEM

WDR (Wide Dynamic Range) Night-Vision Systems are based on non-visible radiation, which directly or in reflected form is sensed by special sensors (cameras), processed, and presented to the driver on a separate display. The screen might be the windshield itself, a separate screen on top of the dashboard, or a screen integrated into the dashboard. WDR (Wide Dynamic Range) Night-Vision Systems can no doubt increase driver vision in night driving considerably.

The modification done here for our proposed system promoted from the existed system is 3D image self processing camera for detecting the intermediate object between target and sensor which will sense that object by sending synchronization pulses (IR pulses)) to the object and the display that will show the processed image of the interfered object to the driver. And for this paper we are using ARM 11 processer for the future extensions also.

Disadvantages of existing concepts:

- Image Processing is not done up to the required level and this will not produce the perfect result too,
- Modern anti-tracking devices such as RADAR jamming systems, camera blinder can lead to system failure,
- System was not directly connected to the vehicle control module,
- Range of object detection was only within 1 m to 7 m.

Advantages of proposed system:

- A wide dynamic range (about 15 m),
- Works in both day and night light,

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- Cost effective, low power dissipation, high SNR and high performance,
- High level of image processing using advanced algorithms,
- It gives fine-better contrast to detect the system,
- Total system is directly interfaced with vehicle control module,
- Applied in military, surveillance & automotive applications.

III. BLOCK DIAGRAM

The block diagram is shown:

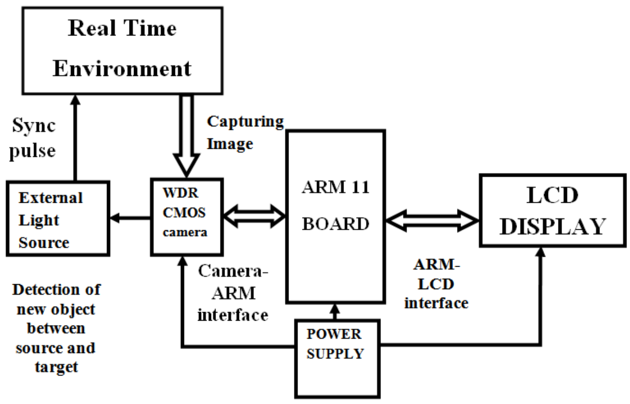

Fig. 1 Block diagram of the proposed system

The above blocks explain the follows:

It is used to sense the opposite vehicles and about the drivers position whether the opponent is in inconvenient position so real time user using the device can able to drive and deviate the car in the other position.

The real time environment user has the clock driven is already inbuilt within it so the external light source is used to synchronize the real time clock.

The WDR CMOS camera will capture the stills and display the view in the LCD display.

The ARM board is used to interface the camera and display.

When the system is booted it is checked whether the interfaces are available.

If it is not present then reassembly takes place.

Else the object is checked for addition.

When the object is obtained the distance is checked such as 15m if it is false means it is not inferred.

Then display the object in the LCD display.

If the distance is checked for 10m the vehicle is stopped.

IV. ALGORITHM

- Initially bias the system with power supply.
- Load the booting codes form the memory.
- Check the interfaces for connectivity, plug and play functionality.
- Execute the codes which are already downloaded in the chip for the operation of CMOS camera.
- Check whether any object is present between source (CMOS camera) and target (real world environment).
- If the object is present within 15 m, then display it on LCD display (intimation to driver).
- Give interrupt signal to wake up the speed control system and head light system.
- If the object is present within 10 m, then apply brake to avoid the accident by sending an interrupt to the speed control module of the vehicle (stop the vehicle).
- Drive the vehicle, if the object moves from the place of our target.
- Repeat conditions throughout the movement of the vehicle operation to avoid accidents.

V. FLOW DIAGRAM

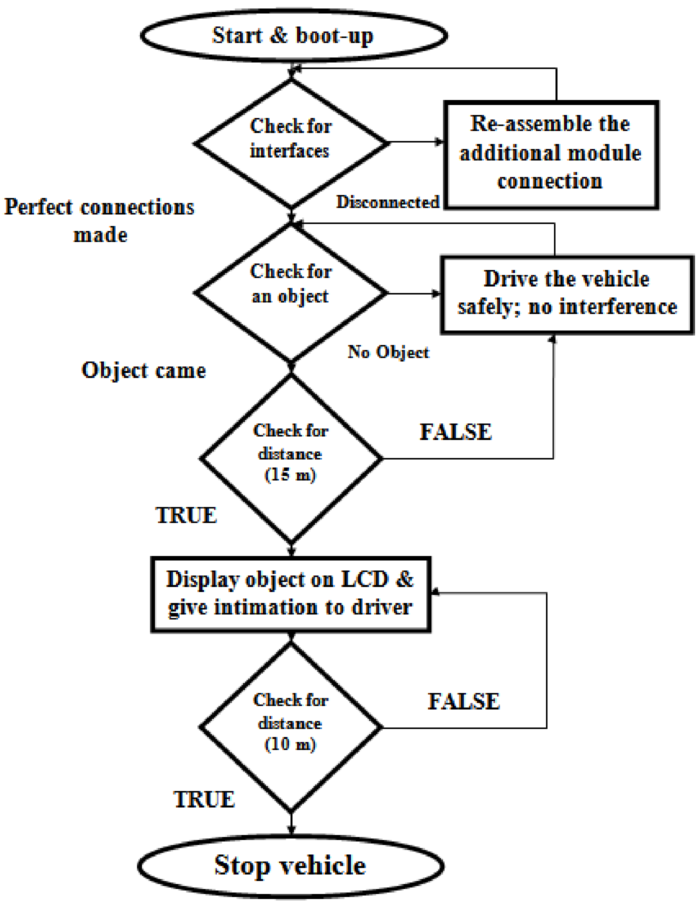

Fig. 2 Flow diagram of the proposed system

VI. OPERATIONAL MODULES INVOLVED

A. Visibility conditions in night driving

At illumination levels typical for night traffic, visual performance is considerably decreased. The two major causes of this reduction are lowered contrast sensitivity and increased glare sensitivity. The result is that the visibility distances drivers have in normal night driving situations on two-lane rural roads are often unsafe considering the speed at with which they drive. In the urban, lighted areas visibility conditions at night are better than in rural areas. On the other hand, there are more unprotected road users in urban areas and their movements on and across the road are much more difficult to predict. Therefore, driver night visibility conditions are often inadequate even in urban areas.

B. The displays

In most head-up displays, the virtual picture is papered a few meters in front of the driver to avoid any accommodation problems when switching between the real traffic scene and the HUD picture. Most HUDs are placed just under the driver's direct line of vision so that the driver will not completely lose contact with the real traffic scene when looking into the HUD, and vice versa. The fact that the driver will have to shift gaze between the real scene and the virtual scene is one of the major potential problems with NVES. The visual field covered by the display has to be large enough to accept reasonable horizontal and vertical curves of the road.

C. Estimation of the total safety effects of NVES

This improved visibility must be balanced with the potential risks to estimate the total safety effects of NVES. According to the preceding analyses, the potential risks of NVES are related to how the enhanced visibility should be presented to the driver, in order:

- Not to increase speed
- Not to cause too much distraction
- Not to cause too much cognitive capture
- Not to increase workload too much
- To be useful to older drivers

D. Optical TOF range measurement

We can measure an absolute distance if we manage to measure the absolute time that a light pulse needs to travel from a target to a reference point, the detector. This indirect distance measurement is possible since we know the speed of light very precisely: c = 3/108 m/s = 2·150 m/□ s = 2·0.15 m/ns = 2·0.15 mm/ps [BRK, BRR]. In practice, the active light source and the receiver are located very closely to each other. This facilitates a compact setup and avoids shadowing effects.

E. Gated imaging

Gated imaging is a class of the Time-Of-Flight imaging technologies where a camera with tightly controlled opening and closing times of the shutter is used in conjunction with a high power pulsed light source. Image contrast is enhanced by gated imaging by limiting the exposure time of the camera to the return time of an emitted light pulse from an object at a defined distance d. If the light source and camera are collocated, the exposure time should occur at a time after light pulse emission.

The principle of gated imaging is outlined in Figure 1 and can be used to enhance image contrast in scenes where the object of interest is obscured by clutter or strong light sources that are blurring or saturating the imager. The camera shutter may be electro-optical, e.g. a Pockel's cell or electrically controlled by CMOS switches in the imaging electronics. The gated imaging technologies may be divided into two distinct classes: Single-shot and Multi-shot. Single shot imagers capture the returned light from one single light pulse and forms and image, while multi-shot imagers integrate the light from several returned light pulses in each image frame.

VII. MULTIPLE APPLICATIONS USING THIS PROPOSED SYSTEM

Some of the applications using this proposed system will be:

Laparoscopy and Surgery- biomedical application, Device driver- hardware initiation, Auto image capturing, Rear-lamp vehicle detection and tracking, People counter, Smart camera stream processor, Motion control, Automated precise measurement, Slip motor control system, Surveillance applications, Vision modeling and high-resolution imaging applications, Noise reduction for LEO satellite applications, Readout structure for 3D integrated imagers, Implementation of embedded image acquisition based on V4L2, Pedestrian detection- a neuromorphic approach, Hardware accelerated address-event processing for high- speed visual object recognition, TOF- distance measurement, Flexible space- time sampling, Robotic fish navigation, Laser imaging inside engines for advanced direct injection gasoline engine development, Barcodes to color codes, Video acquisition between USB2.0-CMOS camera and embedded FPGA system, An industrial camera for color image processing with mixed lighting conditions, Path correction- offline programmed robot welding, Document projection system and etc.

VIII. CONCLUSION

Since the development of automobile headlights, the limited visibility offered to drivers in night traffic has been a problem. The problem was to create headlights with enough intensity to illuminate the road scene at distances far enough in front of the vehicles. From a safety point of view, the light sources available did not match the speeds of the cars. The present head lighting system suffers from one major drawback–the low-beam system. But this paper shows a better secure system for detection of objects in both night traffic as well in the blind environment where a normal human cannot see. It increases the range of coverage to point an object. It is also a better system to avoid accidents which are happening due to no light and over bright conditions.

IX. FUTURE ENHANCEMENT

Here we see that this paper illustrates how is very safety in darken and bright environments with a wide dynamic range of coverage. Here for the phase I of this paper, I designed a system that can detect an object in WDR range only. For the full completion of this paper, I will make this system to present the preloaded commands which are already stored in the background to the driver which is the auto-control of the vehicle. Traffic researchers have been studying systems based on infrared, radar, and ultrasound radiation for many years. Advancements in technology have now made these concepts more attractive and more realistic for wider implementation. Here we can enhance this paper with some more additional feature such as automatic driver, military surveillance monitor, security systems, etc.

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