

WHITE PAPER

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Full-HD / 3D 360° Surround View Monitoring System Product Exclusive Features & Advantage



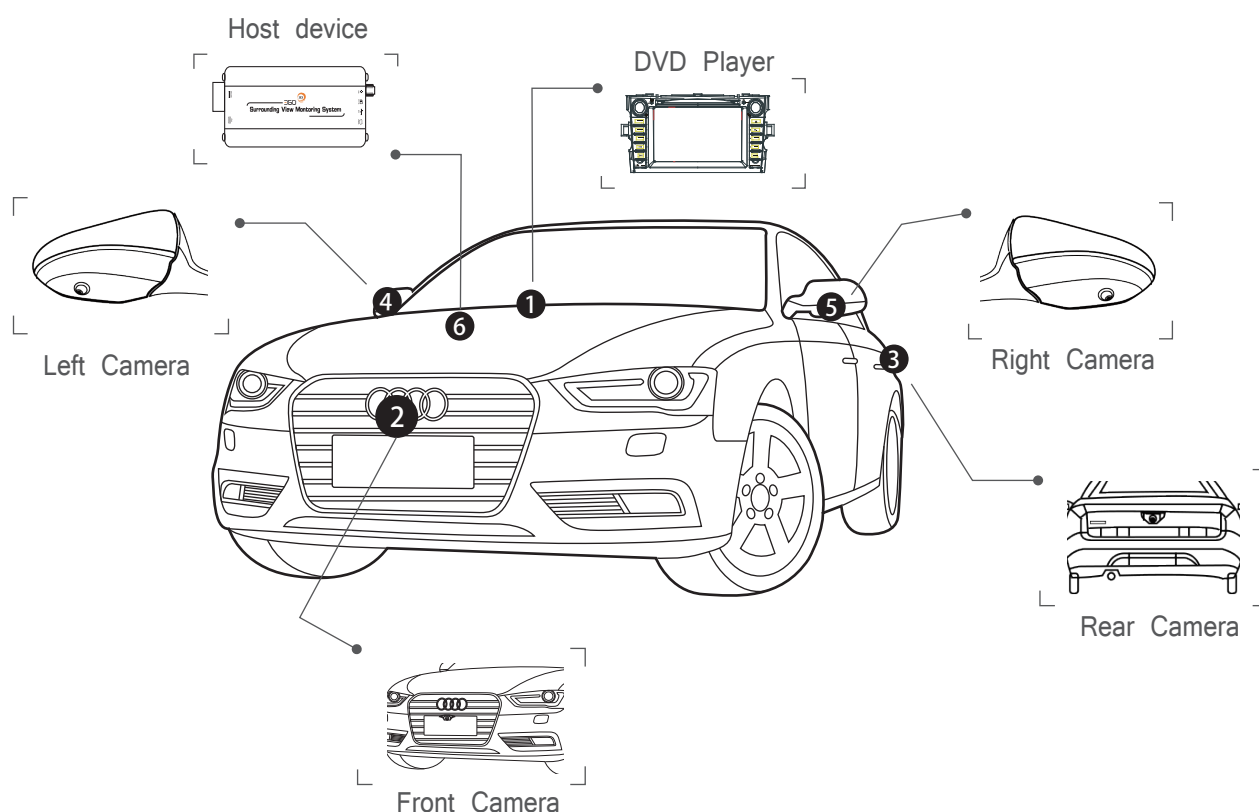
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NEXADAS Full-HD 3D 360 surround view monitoring system solution has successfully employed an innovative architecture of ARM+FPGA. ARM core is unit designed as a general purpose CPU, while FPGA is a dedicate hardware which is used for algorithm acceleration. When comparing with other ARM SOC platform solutions, this unique architecture has big advantages on real time video processing, intelligent power consumption managements and what's more, especially for the 4 channel 720p video resolution support, color restoration and 3D seamless merging and self-adaptive capability for different vehicles, such kind of specifications are usually a big headache for general purpose ARM CPUs but can be easily matched for ARM+FPGA hardware architecture.

This book will illustrate this big advantage of ARM+FPGA platform over ARM SOC platform, and will discuss in detail with competitive all aspect of competitive functions and specification features, of NEXADAS 40nm FPGA solution.

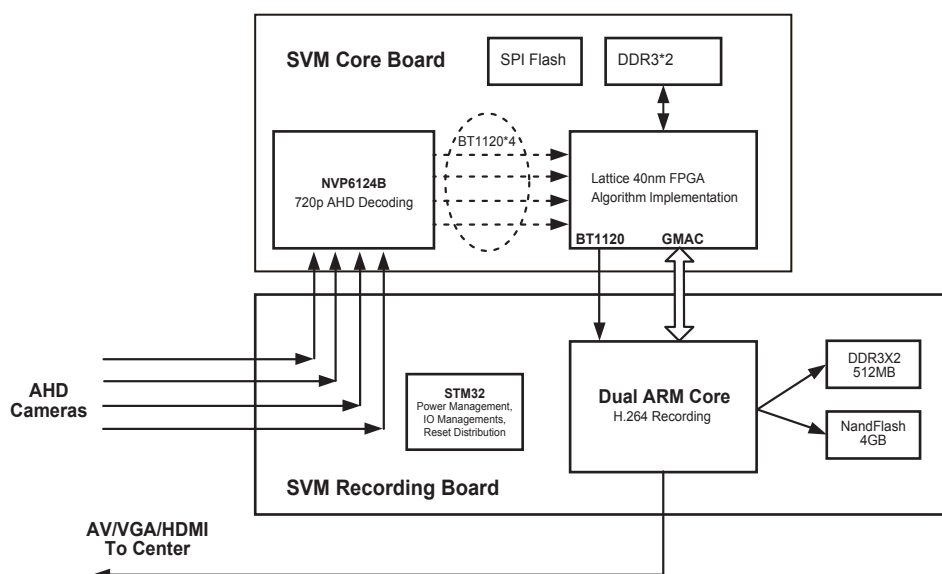
1. Working Principle Introduction



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2. Architecture Introduction



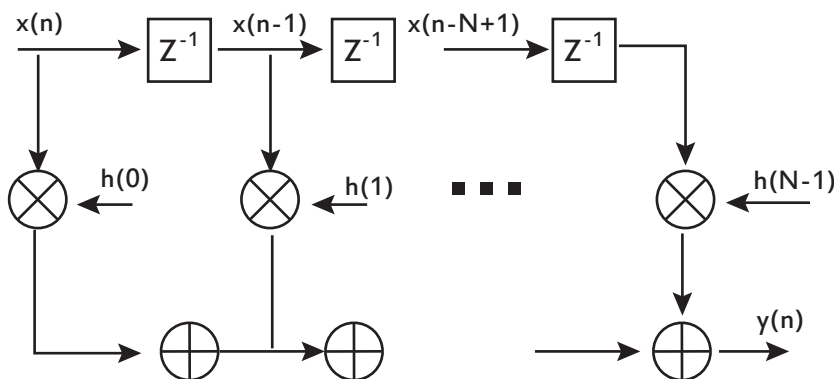
The core architecture is illustrated above. The whole system is made up by two subsystem, one subsystem is FPGA base core board which is dedicated for algorithm implementation and hardware acceleration, while the other one is general multi-core ARM processor which is dedicated for video recording and system managements.

Image and video processing performance is heavily depending on the CPU/GPU processing efficiency and memory bandwidth, but FPGA can implement dedicate algorithm acceleration engine which helps to offload the overhead of generic ARM core based systems when running resource intensive applications. The solution from other competitors are usually low performance SOC/GPU implementation thus there is no hardware acceleration, the CPU will endure a big load on the algorithm implementation. Mega-pixel processing system like SVM system, the memory bandwidth and efficiency will always be a headache for system designers, they have to make a lot of tradeoff between the algorithm efficiency and system performance. It is difficult to expect a perfect image performance and usually the end user will take high risk to experience a software crash or system halted.

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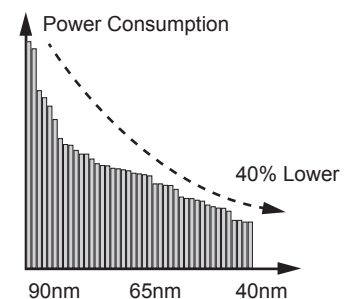
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1. AS a co-processor of general purpose ARM processor, FPGA consists of customized parallel hardware acceleration cell and exclusive full accessible full access capable DDR3 memory so that it can significantly offload the burden of CPU capability and reduce the performance requirements for both CPU and memory bandwidth.

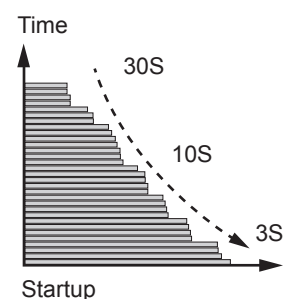


2. As a special algorithm accelerator, FPGA has private hardware cells and IPs for implementing internal data path pipeline to help enhancing the algorithm efficiency.

3. Lattice FPGA is 40nm process base chipset, and the typical power consumption of 40nm's chipsets is generally 40% lower than other chipsets with 90nm process, and the power consumption in standby mode is as lower as 10mA. Along with the population of FPGA application, the cost and power consumption is reduced dramatically which make it is perfect for SVM solution.



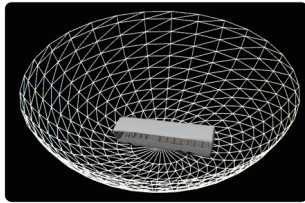
4. Booting time of general Linux operation system is around 10s, and for the startup time for Android system is up to 45s, but, however, FPGA based system can be power up quickly and instant-on within 50ms, and it is possible to drive the display within 3s so that the driver can get the video output within 3s after the engine is start. This instant-on feature of FPGA is quite useful for end user, but it is hard to imagine a startup time as fast as 3s for Linux or Android applications.



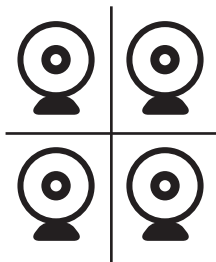
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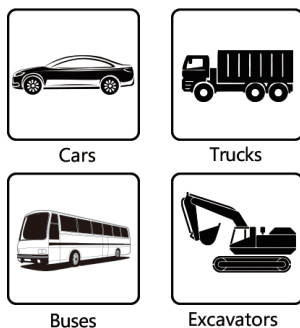
3. Algorithm Advantage



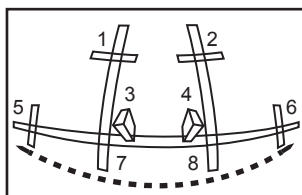
[1] Working Principle



[2] Individual calibration model



[3] Applicable Vehicles



[4] Applicable Vehicles

2.1 Working Principle Introduction.

The NEXADAS 360° 3-D Surround View Monitoring Technology synthesizes images from four cameras to create a true 3D sophisticated view of a vehicle's surroundings. The technology enables flexible omni-directional monitoring around a vehicle from a dynamically definable perspective or "free eye point."

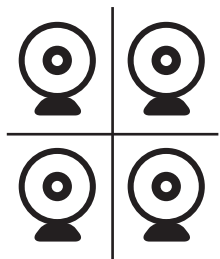
2.2 Exclusive algorithm advantage

A. Since the brain(CPU+GPU) in this SVM system is powerful enough, the algorithm for fish eye camera distortion center evaluation is far better than other competitors, our algorithm do not take a universal model for all outside cameras but a individual model for each camera and our algorithm is sensitive to even a negligible manufacturing parameter difference;

B. We have a real VR based 3D modeling for the outside world and both intrinsic parameters and extrinsic camera parameter is accurately calculated, and now the algorithm is self-adaptive to any kind of vehicle model like dump trucks, lorries, buses, limousines and even tanks or jumbo jets, and such technical innovation will bring u a large business potential because you will never suffer the confusion or reputation loss that why this system is only fit to specific car models;

C. The simplest way for camera calibration, professional facilities such like printed check board and restricted ambient light intensity is not required. You need only 1 single calibration tape paste on the ground and 2 packing box, and the calibration algorithm has less dependency on the ambient light intensity above mentioned;

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[2] Individual camera intrinsic & extrinsic parameters

D. When compare to other system, the final merging effect among 4 outside cameras is perfect and seamless. Again, since the distortion center for fish eye lens and camera intrinsic and extrinsic parameters is accurately evaluated, the end user can expect an accurate 3D modeling of the real world. This system can choose the best view angle for best blind spot coverage, the visual effect after high quality merging algorithm will give you a more colorful world and looks more natural which is friendly to human visual characteristics.

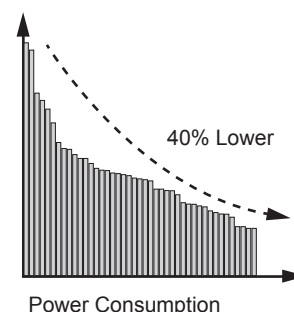
4. Power Managements Advantage

The SVM system has integrated a smart power managements system, it is green and power saving, we have different power management's strategy for following mode which is not mentioned in competitor's datasheet.

SVM mode for less than 3mins: 6W

DVR mode for 24hours: 3.6W

Sleep mode after 72hours: <100mW.



3.1 Renesas & Fujitsu

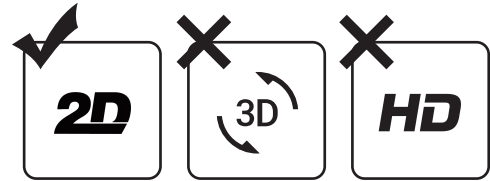
When compare with the solution from Fujitsu and Renesas, NEXADAS have big advantages on power consumption, color restoration, 1080p recording capability and system self-adaptive capability for different lens and vehicle size. Most of solution by providers have strict requirements on lens distortion center variation, and the major market are always focusing on car manufacturers. It is required for the car manufacturers to provide the accurate parameters like camera installation height and angle. Fujitsu's solution is famous for 720p HD/3D and also provide a high quality merging effect, but can only support 1 channel 720p recording and the algorithm is not self adaptive for different vehicle size which can not live up to user's expectations.

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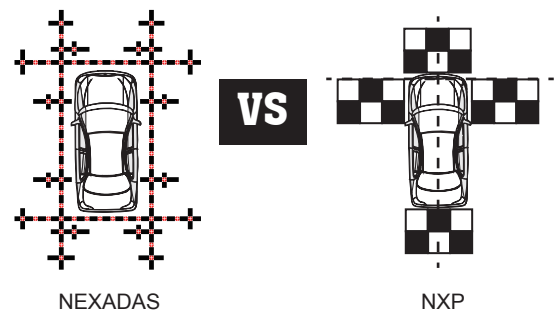
3.2 Telechips

Telechips is a low cost chipset from a Korean company which is originally dedicate for personal tablet, but the market of personal tablet is shrinking fast and so that Telechips will not invest other product model on that market.



3.3 Ti/NXP/Freescale

Ti/NXP/Freescale were only a solution provider for 2D only, with the help of calibration chess board, rulers and a serial of complicate adjust and compensation operations, such solution are highly depending on the illumination conditions but with a merging result which can not fulfill user's requirements. Such algorithm is complete base on geometric projective transformation and without the priors of camera intrinsic and extrinsic parameters, thus the merging result is poor and barely satisfied.



3.4 Hisilicon

As a fast growing local brand in China, Hisilicon get more than 70% market share on IP Cameras and DVRs in security and surveillance industry. Like Hi3520D, with a Coretex A9 @660MHz and dedicate DSP for H.264 video compression But the core ARM processor is very weak when compares with other general purpose ARM core CPUs, no capability for function extension and no support for Android OS, all such shortcomings of Linux based solution will greatly increase the design effort for popular multimedia and internet applications thus it is not an ideal solution for future extension.



The system also has a smart unit which called safe voltage threshold detection for the battery, and as soon as the voltage is drop under the detection threshold, the system will shut down to prevent the host from always consuming power from the battery.

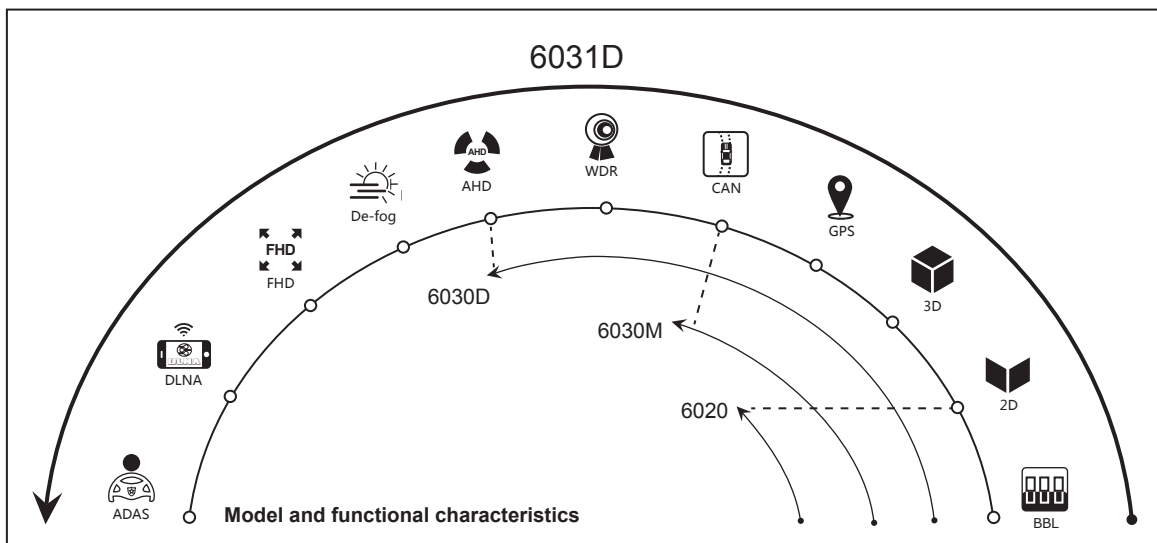
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5. Comparison Table

	Input Resolution	Recording Resolution	Lens Adaption	WDR	2D/3D	Calibration Method	Intellectual Property	Potential Market	Cost
Hisilicon	720p AHD	720p*5CH	---	---	2D	Chessboard	✓	After Market/Car Dealer	Low
Renesas	D1	D1	---	---	3D	Chessboard	---	Car Manufacture	High
Telechips	D1	D1	---	---	2D	Chessboard	---	After Market/Car Dealer	Low
Fujitsu	720p	720p	---	TBD	3D	Chessboard	---	Car Manufacture	High
Allwinner	D1	1440*960p	---	---	3D	Chessboard	✓	After Market/Car Dealer	High
Ti	D1	D1	---	---	2D	Chessboard	✓	After Market/Car Dealer	Medium
NXP	D1	D1	---	---	2D	Chessboard	✓	After Market/Car Dealer	Medium
NEXADAS	720p AHD	1080p	✓	✓	3D	Calibration Tape	✓	After Market/-Car Dealer/Car Manufacture	Cost Effective

6. Roadmap



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8. Revision History

The following table illustrates the revision history of this technical document:

Date	Revision	Note
5 / 8 / 2016	1.0	NEXADAS initial version
1 / 9 / 2016	1.1	Revised version

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