NovaStar High Image Quality Solution

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Ⅰ. Overview

Over the past few years, the LED industry has already entered a small-pixel pitch era. With LED getting used indoors more often, customers getting more and more professional, and the requirement on display getting higher and higher, the display effect has already lagged behind the demand of some high-end applications or professional customers.

From the market response, now the small pixel-pitch LED emphasizes display effect and meets some hard-to-solve issues, such as color cast and layering on low grayscale area, and colors not pure.

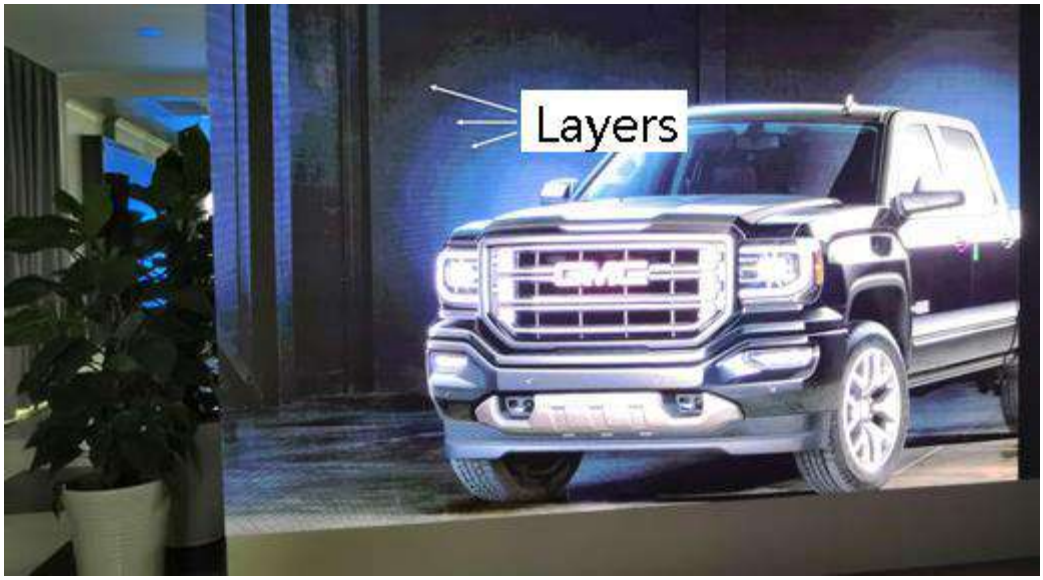
Grayscale layering

On all LED screens, there’ s a common issue that some noticeable border lines appear in the low grayscale area where our eyes are sensitive. This issue can get more severe if the brightness decreases.

Imagine this issue happens when projecting the content from the live camera to the Led screen on an auto show, surely customers may get unsatisfied and fill a complaint.

Color Cast

It’ s clear to see that many grayscale levels have different color cast issues.



More and more LED screens are getting into the meeting room. There are constant situations during meetings，like PPT presentations and corporate promotional videos. In those PPTs and videos, there are some low-grayscale background pictures or scenes where the bosses won’ t be satisfied, so the visitors can feel frustrated if layers of the color cast show up.

Apart from auto shows and meeting rooms, this low-grayscale issue exists in many indoor scenarios, such as images captured by the cameras in the surveillance room, the background in a stage display, the promotional video played on an advertisement screen, and films in a cinema.

Impure Colors

Many customers have given feedbacks that the colors on the LED screen are different from the actual colors on the input source. (cameras, PCs, players, etc.)

Some issues are common such as red skin in the rental, conference, and surveillance scenarios.

Similarly, the commercial field will meet this problem. For example, the color of the logos could be different from their original ones.

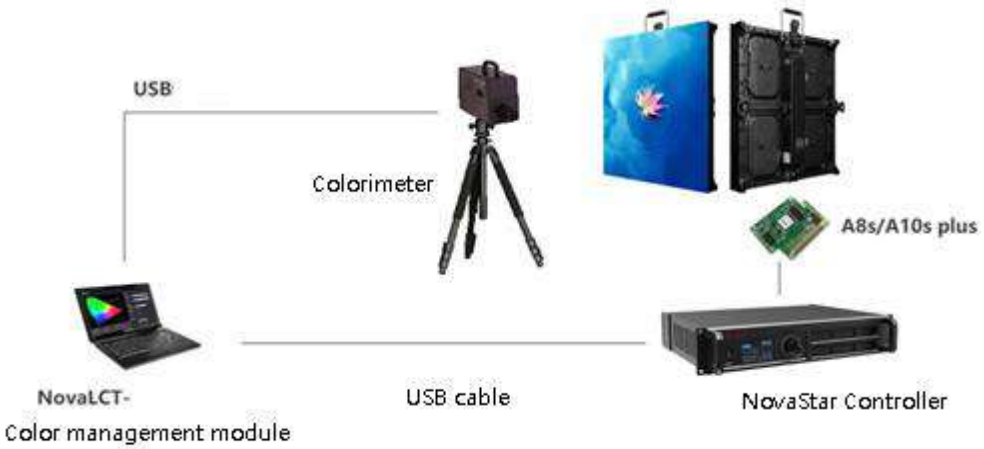
The reason why color management is not applying on the LED screen is that the technology is missing in the industry, and the color gamut of the LED screen exceeds the gamut in a regular video. Once standardized color management is applied, the saturation can decrease instead. So this technology is not being taken seriously. But now more and more LED screens are entering the commercial display market, issues such as impure colors and skin tone distortion are getting noticed. More importantly, as the ultra-high resolution video flourishes in the world, BT.2020 gamut will be more popular, and this technology can become indispensable. Once it' s missing, not only the colors could be incorrect, the vividness and image quality could get worse.

Ⅱ. NovaStar High Image Quality Solution

1 System Diagram

Therefore, NovaStar launched a high image quality solution for small-pitch indoor screens- Image boost engine. Based on A8s/A10s plus receiving cards, which can increase the grayscale by 64 times, implement standard gamut management, erase the color difference, it can restore the real world colors, making small-pitch LED screens to satisfy the requirements for high-end display.

The following figure is the connection diagram of the data-capture system, which uses a colorimeter to capture the RGB grayscale and color, then applies the image boost engine algorithm for optimization, solving the grayscale and color issues.



2 Principles

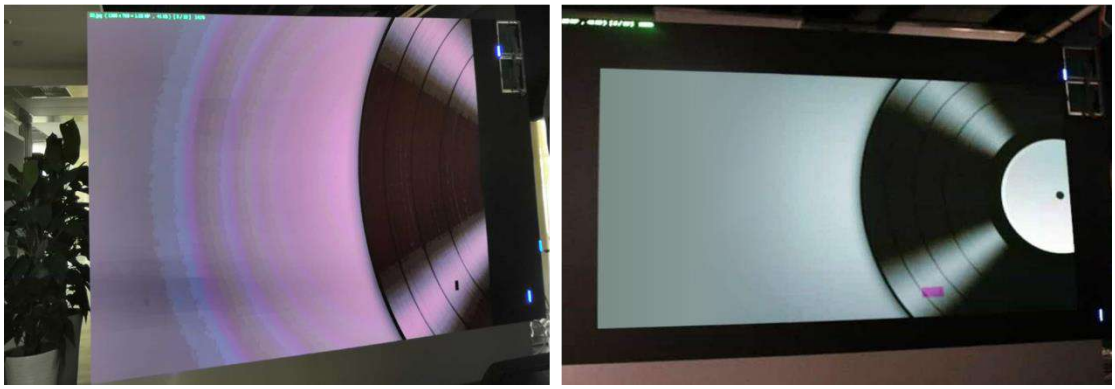
2.1 22Bit+ technology

By using A8s/A10s Plus receiving cards, this 22Bit+ technology increases grayscale levels by 6bit, which is 64 times more. It erases merging on grayscale, makes it smoother, and bring better details to the image.

2.2 Precise grayscale technology

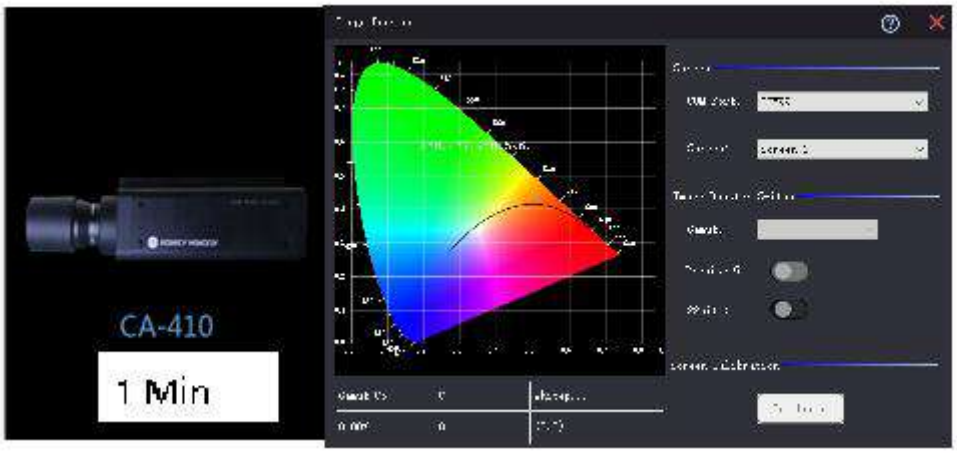
NovaStar precise grayscale technology implements level-by-level measurement on 16bits (65536 levels) grayscale of the driver IC. By utilizing the software algorithm, it can achieve level-by-level calibration, bring smoother transitions, improve quality on the low-grayscale display.

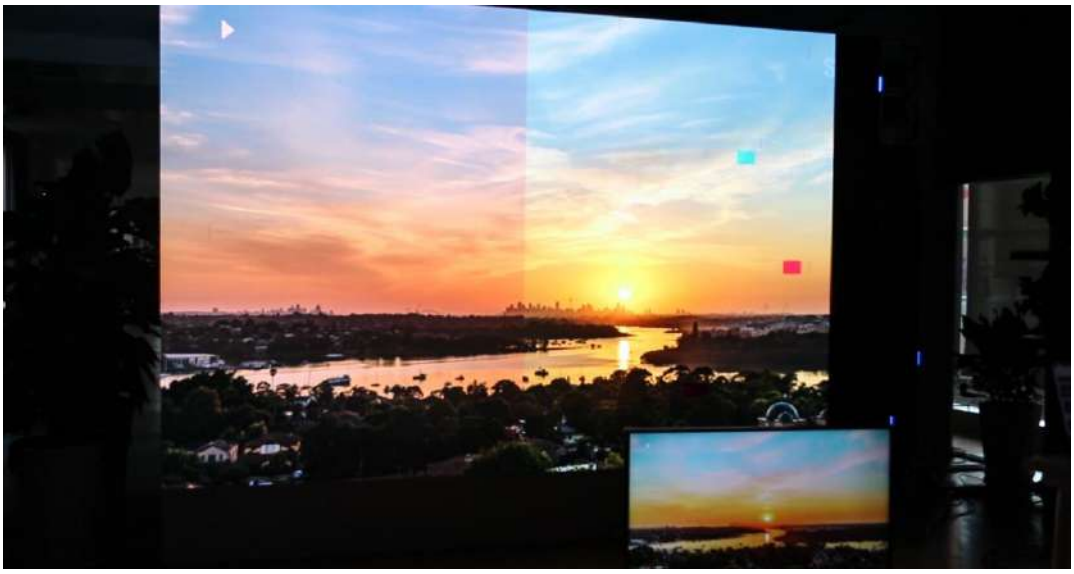
Grayscale	Boost engine OFF (nits)	Boost engine ON (nits)	Standard	Gap between OFF and standard	Gap between on and standard
0	0	0	0.0000	0	0
1	0.2130	0.0021	0.0038	0.2092	(0.0017)
2	0.2387	0.0062	0.0076	0.2311	(0.0014)
3	0.3711	0.0089	0.0114	0.3597	(0.0025)
4	0.5127	0.0121	0.0153	0.4974	(0.0031)
5	0.6536	0.0159	0.0191	0.6345	(0.0031)
6	0.7951	0.0202	0.0267	0.7684	(0.0065)
7	0.9363	0.0395	0.0420	0.8943	(0.0025)
8	1.0748	0.0644	0.0610	1.0137	0.0033
9	1.2029	0.0922	0.0839	1.1190	0.0083
10	1.3836	0.1275	0.1144	1.2692	0.0130
11	1.5279	0.1657	0.1488	1.3791	0.0170
12	1.6541	0.2103	0.1907	1.4633	0.0196
13	1.7768	0.2569	0.2365	1.5403	0.0204
14	1.9036	0.3149	0.2937	1.6099	0.0212
15	2.0356	0.3777	0.3586	1.6771	0.0191



2.3 Color management technology

By utilizing A8s/A10s receiving cards and the color management module in the NovaLCT software, NovaStar color management technology can perform automatic capturing, calibration, and verification. It can adjust the color gamut to match with the gamut of the picture or video source, eventually erasing the color difference and reproduce the natural colors.





Ⅲ. Device selection

Device selection should depend on the specifications of the screen.

Products	Models	Unit	Quantity	Notes
Receiving card	A8s ， A10s Plus	Pcs		Based on screen specifications

Colorimeter	CA410 (Recommended), CS150，CS2000	Pcs	1	Only one colorimeter is required. Measuring A single cabinet is sufficient if all cabinets are in the same batch. Just upload the parameter to all cabinets.

IV. Advantages

1. Easy operation: Automatically detects and obtains the screen configuration with no manual operation required.

2. Quick setup: Only one sample cabinet is enough for one batch of cabinets. Coupled with CA-410 colorimeter, it just takes 15 minutes to finish capturing, generating, and uploading co-efficient to the whole screen by clicking “Start” on the software.

3. Simple design: Just click “on/off” on the software.

4. Switch between multiple gamut standards (BT709, DCI P3, BT2020, etc.) to fulfill requirements on various scenarios.

5. Gamut assessment report can be generated for professional projects.

Target gamut BT.709 Time: 2020-05-07

BT709 cover rate: 98.54%

Value

Standard color	CIE31(Lxy)			Image engine OFF				Image engine on			
	L	x	y	L	x	y	DeltaE	L	x	y	DeltaE
#745244	95.11988294	0.35167	0.3469	107.338	0.3524	0.34808	3.45897	95.094	0.3509	0.34848	0.86379
#D9792F	146.7151453	0.41467	0.3995	167.21	0.4337	0.39776	10.5056	146.34	0.4138	0.40082	0.79049
#2E3E95	69.95356625	0.24055	0.2294	78.6053	0.21212	0.23068	14.9909	70.3872	0.24098	0.23135	0.96099
#F6F3ED	262.2292221	0.31516	0.33165	289.998	0.29967	0.33326	10.3114	262.132	0.31474	0.33182	0.30603
#C49582	169.9522385	0.34231	0.34243	190.847	0.33941	0.34319	4.11208	169.828	0.34171	0.34302	0.51264
#455CA3	99.44994817	0.25917	0.26335	110.299	0.23062	0.26444	15.3886	99.8773	0.25929	0.26476	0.74082
#45924A	134.1622849	0.30573	0.40462	141.056	0.259	0.42156	25.3614	134.186	0.30521	0.40551	0.49943
#C8C8C7	215.5669684	0.31302	0.32953	238.358	0.29696	0.33132	10.0702	215.643	0.3127	0.32991	0.34283
#5C7998	126.4627493	0.27995	0.30074	138.89	0.25196	0.30282	15.2908	126.835	0.2798	0.30186	0.64123
#C65562	118.5687478	0.37408	0.31708	139.728	0.39165	0.31548	10.5825	118.66	0.37298	0.31841	0.98543
#B12D38	79.64028454	0.42197	0.31422	98.0701	0.45567	0.31102	16.6115	79.7002	0.42071	0.31644	1.30719
#9E9E9F	170.4372377	0.31229	0.32833	188.632	0.29623	0.3303	9.4066	170.529	0.31198	0.32897	0.45279
#5B6B45	108.7437118	0.3278	0.37465	118.158	0.30704	0.38176	10.7381	108.718	0.32712	0.37603	0.7326
#5A3D67	75.68982711	0.30443	0.27569	87.0613	0.29929	0.27716	4.15427	75.9765	0.30413	0.2778	1.11732
#EBC32F	207.9043427	0.39764	0.43783	228.825	0.40145	0.44435	6.33562	207.366	0.39646	0.43822	0.61824
#777978	129.9287243	0.31208	0.32988	143.654	0.29507	0.3323	9.13493	130.049	0.31153	0.33082	0.63233
#827FAC	141.1250475	0.2942	0.29606	157.57	0.27718	0.29721	9.62257	141.329	0.29405	0.29703	0.59122
#9D8848	183.4848432	0.35257	0.418	198.083	0.33531	0.42905	11.5907	183.255	0.35188	0.41852	0.44464
#BD5290	117.7725758	0.33925	0.27809	139.665	0.35077	0.27836	8.45528	117.818	0.3387	0.27929	0.871
#535454	90.34154681	0.31187	0.329	99.9065	0.29508	0.33202	8.1797	90.4391	0.3114	0.33066	0.84441
#5D8AA8	177.8262191	0.27944	0.34092	189.428	0.23644	0.34703	26.0579	177.943	0.27939	0.34133	0.23016
#E39E34	177.9282139	0.40159	0.41549	198.914	0.41182	0.4175	6.99853	177.514	0.40053	0.41628	0.66305
#0083A2	113.6256774	0.21672	0.30018	117.172	0.13672	0.30523	51.4418	114.132	0.21743	0.30147	0.49333
#363617	58.30193761	0.31152	0.32704	64.5822	0.29519	0.33107	7.18946	58.3922	0.3112	0.32997	1.17727