Re: Driving many led's (400+)

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- *From*: Greegor <Greegor47@xxxxxxxxx>
- *Date*: Mon, 19 Jan 2009 15:52:01 −0800 (PST)

On Jan 19, 4:53 pm, "Jon Slaughter" <Jon_Slaugh...@xxxxxxxxxxx> wrote:

> "Paul Hovnanian P.E." <p...@xxxxxxxxxxxxx> wrote in messagenews:4974F210.C69524D@xxxxxxxxxxxxxxxx
>
> > Jon Slaughter wrote:
> >
> > > I have an application where I need to drive 400+(~150 rgb's) individually.
> > >
> > > I was thinking about using the
> > >
> > > TLC5947−−−TI−−−24CH 12bit PWM LED Constant Current Driver
> > >
> > > as this was the first one I looked at where each LED had it's own
> > > channel.
> >
> > Is that actually a requirement?
>
> ? I have 100+ rgb LED's where each rgb LED will be used for multi−color. Hence every individual LED needs brightness control(hence the PWM).
>
> > > That way I had complete control. It whould require 20+ of these and each

> > one
> > costs about 4$. It seems like a nice package and the only
> > problem I have
> > is
> > setting the same q current for all of the IC's(so they all have
> > the same
> > brightness at the same level).

> If you are going to be controlling things individually (i.e. in a matrix display), equal brightness isn't as big an issue. With some LEDs on and some off, and the display changing, nobody will notice some non−uniformity.

Depends. This isn't a "display" and the LED's are scattered about(not random but they are not packed tightly). They may or may not change but they will not change often(maybe at most a few times a second).

Slight fluxuations in brightness won't be a huge deal and they calibrated out if necessary but I'd rather not have to do that.

My idea right now is to basically use C mosfets, 1 for each column, and R mosfets, 1 per row. This gives me the matrix and current capacity. The rows will be driven by a ring counter and the columns by a mosfet driver that is controlled by a uP.

I believe that will work and the only problem is coordinating the row's with the individual PWM(which becomes sorta modulated by the refresh rate). I think by choosing the refresh rate to be large would be ok but might cause other problems.

> If the point is to produce a uniform brightness across a panel, you are going to have problems with LED tolerances. Particularly if you can't get 1000 of the same P/N, from the same manufacturing batch.

Slight variances are not a big issue. And Again, I'm sure they can be calibrated out if I have control of individual brightness. (i.e., say one LED is too bright, I can just reduce the current to it... I'll have a lookup table for all the LED's for changes)

I don't think it will be a huge problem though. I have to keep a table anyways because I don't think brightness is proportional to the PWM frequency?

On Jan 19, 3:07 pm, John Devereux <j...@xxxxxxxxxxxxxx> wrote:

"Jon Slaughter" <Jon_Slaugh...@xxxxxxxxxxx> writes:

> So basically I need to drive the rows with C*I where I is the current per LED. This gives the peak current through an LED while it is on as C*I but on average, since there will be C cycles, of just I. The driver needs to be able to supply C*I current too(per row).
>
> Unfortunately the peak current per LED is about 100 which is just 4 times the average current. This means I can only have 4 rows ;/ but reduces the number of drivers I needed originally by a factor of 4 which is better. (I have 18 rows and 24 columns)
>
> The TI IC can only deliever 30mA so this is out of the question as I would need about 100mA or so. The ST has 80mA maximum. I might have to go with
> this as there are no too many 24−ch drivers. Of course thats absolute max ;/
>
> Maybe I would just have to go with 24 discrete mosfets for the column's and 18 discrete for the rows and then use some mosfet driver chips + uP to drive? This of course is more work but solves the power capability issues. Alternatively maybe I can find some LED drivers that have a larger capacity at 16 ch.
>
> Of course I'm looking at the worse case of all the LED's being on but since it's not an impossibility...

Are you trying for individual proportional control of each led, or
just on−off control maybe with overall dimming (of all together)?

−−

John Devereux

Do these people source their subsystems out to others?

How long have RGB LEDs been around?
Are they economical yet?

http://www.lsi−industries.com/contentindex.asp?ID=6

http://www.smartvision.com/eng/products/indoor.asp?id=30

Silverstar YG−LED 109 Matrix Panel
http://www.nordiskmusik.se/default.asp?id=17992

http://www.ledsignsupply.com/?gclid=CM3IlMrZm5gCFRwwawod0joUnA

http://www.ecvv.com/product/vp1345904/indoor−full−color−led−display.html

http://www.panstadia.com/vol5/54−028.htm

http://www.ledsmagazine.com/news/3/6/25

Old, but I thought some of the description might help,
like the part about "shouldering" for example.
But if you're using RGB LEDs that shouldn't be trouble, right?

http://digitalcontentproducer.com/mag/avinstall_led_displays_light/

LED DISPLAYS: light up the big screen
Jan 1, 2000 12:00 PM, Peter H. Putman

Previous columns covering large−screen displays mainly focused on projectors and monitors using emissive (CRT and plasma) technology for direct−view monitors, and we have concentrated on transmissive (LCD) and reflective (LCD and DLP) imaging for high−brightness large screen displays. In many of these applications, the ambient lighting environment is controlled to maximize image contrast and legibility. That is not always possible when designing and installing electronic displays in arenas and stadiums. Outdoor stadiums in particular present a lighting environment that can be characterized as hostile − extremely bright sunlight, pronounced shadows, variable color temperature and plenty of glare.

The new breed of arena builders are not satisfied with simple black−and−white dot matrix displays for player stats, animated graphics and advertising/promotions. The typical sports fan (or concert attendee) is used to a steady diet of video and fancy visual effects, not to mention instant replay. For them, full−color, full−motion video is the only way to go.

How do they get there? Front projection systems are certainly bright enough to light up 40 foot (12 m) wide screens with long projection throws but cannot produce enough contrast under daylight levels that can exceed 20,000 lux. Videowalls can crank up the brightness, but they do not provide wide enough viewing angles, and their rear−screen surfaces are easily washed out in direct sunlight.

The answer is to construct an emissive display that delivers a point source of light bright enough to be seen more than 200 yards (183 m) away under any kind of lighting. This ideal display would be visible from viewing angles up to 160 degrees, provide full−color imaging (at least 8 bit processing per color channel) and have a refresh rate fast enough to show video. Perhaps this emissive display could also be constructed in a modular fashion for easy assembly. While we are at it, let's try to keep the weight down and the footprint small.

A pipe dream? Not really. Using nothing more than the garden−variety light emitting diode (LED), a switching matrix and a lot of wiring, SACO Smartvision of Montreal has been assembling some pretty impressive direct−view displays for indoor and outdoor venues, among them the Oakland−Alameda County Coliseum, the MCI Center in Washington, D.C., and PSI Net Stadium in Baltimore, home of the Baltimore Ravens football team.

The LED display concept is not new. LEDs have been used for crude, low−resolution signboards for years, and they have also been put to work in matrix configurations for numeric and character displays. The reason they work well in large screens has to do with our perception of image resolution. If you have a magnifying glass handy, hold it over an advertisement or photograph in this magazine. You will see thousands of colored dots or pixels, which make up the screen of the photograph. At close range, these dots are quite noticeable, but at normal viewing distances, you do not see the dots, just the image that they form.

LED displays work exactly the same way. Viewed up close, they are a jumble of red, green and blue dots. As you back away from the display, the dots become less noticeable. Eventually, your eyes stop paying attention to the display structure and concentrate instead on the images being formed. Depending on how coarse or fine the matrix of LEDs, this distance will vary from tens to hundreds of feet.

SACO's Smartvision screens are manufactured in a variety of screen resolutions, primarily determined by the effective pixel pitch. In a CRT display, that pitch is determined by the spot size of the electron gun as it traces a raster and is typically less than 1 mm. Plasma displays can have slightly large pixels close to 1 mm, while such matrix displays as LCDs and DMDs are considerably smaller and are measured in nanometers.

In contrast, the smallest pixel configuration in a Smartvision display measures 4 mm, about 225infinity larger than a single pixel in a 0.7 inch (18 mm) diagonal SVGA LCD panel. The largest pixel matrix for an indoor Smartvision screen is 15 mm, while the largest available for an outdoor screen is 40 mm. Obviously, these screens were designed for viewing at long distances. SACO's recommended minimum viewing distance for a 4 mm pitch array is 10 feet (3 mm), while the 30 mm and 40 mm arrays are specified for a 100 foot (30 m) viewing distance.

Using custom interfaces and driver boards, the individual pixel matrixes are driven in a progressive−scan configuration. This allows the display of both line−doubled video and computer graphics at a 60 Hz refresh rate.

How bright of an image will you see? SACO claims up to 2,500 candelas/m superscript 2 for its indoor displays and between 5,000 candelas/m superscript 2 and 6,000 candelas/m superscript 2 for the outdoor versions. Ambient light levels indoors are more easily controlled, and it is easy to obtain high contrast from such a display; there is little light spilling on the screen surface that will reduce contrast.

Outdoors, however, things are different. As I write this article, it is raining outside, and the sky is a dark, overcast gray. Even so, a quick light reading shows that I still have more than 1,760 candelas/m superscript 2 of daylight to contend with, which would reduce image contrast to 2.8:1 using a 5,000 candelas/m superscript 2 Smartvision LED array. So, another trick is used to kick up contrast − small horizontal louvers that line the top of each Smartvision four−pixel array. This louver can reduce stray light levels by a factor of eight or more, boosting image contrast by a corresponding amount.

The secret to making these displays work was the discovery of a bright blue LED, a process that has stumped engineers for many years. There is something about the color blue that has also vexed scientists in laser technology. In a typical Smartvision outdoor pixel matrix, four individual five−LED arrays contain eight red LEDs, eight green LEDs and four blue LEDs. The red and green LEDs surround the blue LEDs and the effect looks like four dice rolled to show fives.

SACO claims 150,000 hours for each LED with a brightness fall−off of only 15% after 100,000 hours of operation. It is possible to get even more illumination from LEDs, but at an accelerated aging cycle. Maximum viewing angles are specified at 170 degrees and 90 degrees vertically.

There is a phenomenon to LED displays, known as shouldering, that will affect normal viewing. Shouldering is caused by mutual obstruction among adjacent LEDs, creating noticeable color shifts. For example, if you are positioned at increasingly acute viewing angles from an outdoor screen using the 4infinity1 matrix, you will notice more red and green in the image and less blue as many of the blue LEDs are partially blocked from view.

I traveled to two different arenas to check out a couple of Smartvision screens recently, both installed by Professional Products of Maryland. The first installation is part of a scoreboard in the brand−new Sovereign Bank Arena in Trenton, NJ. This 8,000 seat venue (10,000 for concerts) hosts both minor league hockey and basketball games, and uses four 79infinity99 (2.1 m infinity 2.7 m) arrays of Smartvision panels for video replays, advertisements, promotions and special video graphics. The screens in this arena are the brightest thing you see in the arena, even more so than the spotlights on the ice.

Each panel is made up of a 16 infinity 16 LED matrix containing 256 red, green and blue LEDs, and there are 99 panels per screen (11 horizontal rows and nine vertical rows). The effective pixel resolution of each active display is 2,816 infinity 2,304 sets of red, green and blue LEDs. SACO uses 10 bit 4:2:2 component signal processing or 1,024 colors per red, green and blue channel. The interface is all digital and conforms to SMPTE 259M and CCIR−601 using single coaxial cables for signal distribution.

Laura Black, the technical services coordinator for Sovereign Bank Arena, uses a variety of formats to feed video and graphics to the hanging video board, including Sony DVCAM and VHS videotape playback. A Media 100 workstation is used for editing and special graphics effects, and a variety of Videotek DDRs and framestores are available for replays and still shots. Up to nine cameras can be handled through a Ross RVS210A switcher, and a Pinnacle Deko 500 system provides real−time video SFX.

About 100 miles (161 km) to the south, the staff at the Baltimore Ravens facility have configured a unique Smartvision screen into their own proprietary game−day video system they call "Raven Image". The pair of LED displays sit at opposite ends of PSINet Stadium and measure 100 feet wide by 25 feet high (30 m infinity 7.6 m) with a viewable area of 969infinity249 (29 m infinity 7.3 m). Unlike other stadiums where electronic displays are mounted high about the nosebleed seats, these two screens sit nicely between the first and second levels of the stadium, providing a more natural sightline.

Both screens use the 30 mm outdoor 4infinity1 pixel array and are actually made up of two complete 489infinity249 (14.6 m infinity 7.3 m) screens that are precisely aligned to provide a 4:1 panoramic image. As a result, there are four remote controls setting up and calibrating the two screens. All video and graphics originate in a sophisticated production studio that takes 15 people to operate during a game. All images are captured, edited and manipulated as 16:9 525−line video in the studio then effectively cropped by the long, narrow Smartvision screen.

According to producer/director Marcia Kapustin, no other professional sports team uses such an unusual production and display format, which she considers ideal for the perspective of a football game. What is even more interesting is that Raven Image runs continuously during a game, just like a network broadcast. In fact, the Raven Image crew will sometimes take camera feeds from CBS NFL telecasts and mix them with its own 16:9 widescreen coverage.

The control room at PSINet Stadium includes a full−bore Sony DVS−7250 digital switcher with a raft of Ikegami cameras set up with 16:9 monitors for acquisition and three Tektronix PDR200 Profile disc recorders/players with 12 channels of video for instant replay and video segments. Up to 10 cameras can be sourced, and several Type DeKo and Pinnacle DVExtreme boxes are online for special effects. Four DPS 465 frame synchronizers feed each of the four individual screens, and Panorama aspect ratio converters can be used to resize 4:3 material to the 16:9 format.

During my visit, the sun moved in and out of cloud cover and completely illuminated the west screen. Despite this much ambient light, there was enough contrast (about 10:1) in the image to clearly see the clips of an earlier game. No doubt, the louvers helped because the full daylight levels would have been far in excess of 5,000 candelas/m superscript 2 (low haze, direct sunlight). Of course, both screens are in the field of view of at least 75% of the spectators, so there is always one screen that is fully legible.

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