

# LED strips

*Following on from the discussions on Friday night, I thought that I could commit some thoughts to paper, and here they are.....*

There are numerous different types of strips available and the things to consider are ....

- 1) The number of LEDs per metre
- 2) The operating voltage
- 3) The base colour of the strip backing
- 4) The weather resistance
- 5) How they are controlled. i.e. there are individually addressable LEDs or non-addressable LEDs
- 6) The cost

## **1) Number of LEDs per metre**

Strips are typically available in 30, 60, 96 or 144 LEDs per metre. The choice is yours, depending on what you are trying to achieve, display wise.

## **2) The operating Voltage**

Typically available in 5v, 12v or 24v versions. The lower voltages draw more current and the losses in the cables and tracks increase dramatically with increase in current. This is less of an issue with small displays but the cables feeding them need to be thicker. For example, 5 metres of 96 leds/metre could draw about 10 amps or more. 24v would be the way to go, with 12v being suitable for smaller displays. However, 24v is less common on the retail market and you may need to shop around. Also, the choice is complicated by the fact that the higher voltages tend to control the LEDs in groups rather than individually. This could adversely affect the display,

## **3) The Background Colour**

The LEDs are mounted on a self-adhesive plastic strip about 10mm wide, which is typically available in black or white

## **4) The Weather Resistance**

Strips are available with various degrees of weather proofing.

IP30 - Not suitable for outdoor use

IP65 - Proof against water jets

IP67 - Proof against being submerged in water for a short time

IP68 - Proof against being submerged in water for an extended time.

In practice, something like IP65 but protected by a clear plastic tube is probably the way to go for Christmas lights as it offers robust mechanical and weather protection.

## 5) Basic Types

Number five above is the most important because it alters what you need to do to drive the strips. The individually addressable strips only need a single data line to drive them and can be driven directly from a 5v Arduino. Alternatively, the non-addressable strips need mosfet drivers to control each section of the display.

Common types available include .....

**WS2811** - 12v LEDs controlled in groups of 3

**WS2812** - small leds - not recommended

**WS2812B** - 5v individual control of each LED, reverse polarity protection, updated design, chip integrated into the LED - very popular

**WS2815** - 12v - 2 data lines for increased reliability

Either way, the cost is about the same, because whilst the addressable ones do not need mosfet drivers, they are more expensive and the cost works out the same. The addressable variety is slightly more difficult to program but can be used to create much more dynamic display patterns. Non addressable LEDs require multiple connections between the microcontroller and the driver board and multiple connections between the driver board and the LED display. This creates difficulties on the practicality front.

My own view is that the individually addressable route is the way to go

Note that most of the addressable strips require 5v data signals which would suggest that a level shifter is required if driving them from a 3.3v device such as an ESP32. This level shifter requires a 5v supply.

## Conclusion

My gut feeling is that each display section eg a wheel, kangaroo or ferris wheel should be self contained with its own power regulator, and wifi connected controller. My thinking is currently leaning towards programmable pixels rather than straight RGB strips. The power bus should be about 24v with each display dropping this down to 5v (or whatever operating voltage is decided upon). This is to reduce the wire guage of the power bus (ring main) supply and to increase voltage stabilisation in each display.

## The way forward

Just to confirm that all this theory makes sense, I'm going to order 5m of addressable strip and build a suitable ESP32 based driver assembly to make it all happen.

Meanwhile, Peter is in possession of an ESP32 board with 16 mosfet drivers mounted on it. If he can get it under control, then we could possibly do something similar with that, just to show the other side of the coin.

***Robbie Burns***

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