Building Absurd Christmas Light Shows

Computer Controlled Lights

<Video of light show>

Basic Elements of a Light Show

- LEDs
- Power Supplies
- Waterproof cases
- Cabling
- Pixel Controllers
- Sequencing Software
- Show Controller + Software
- FM Transmitter

+Zip Ties….
Lots and lots of zip ties

Traditional Mini-Lights

LEDs used here

- 3 LEDS on 1 chip

Creating Colors

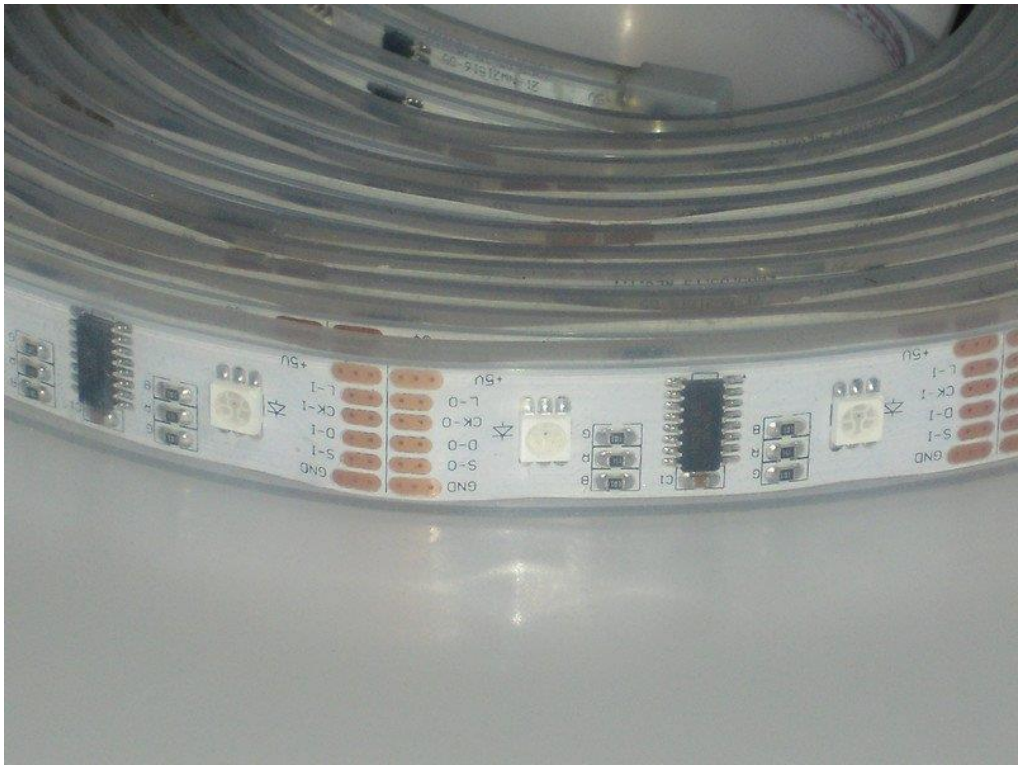
Red, Green, Blue LEDS combine to make colors

Additive Color

Additive Colors

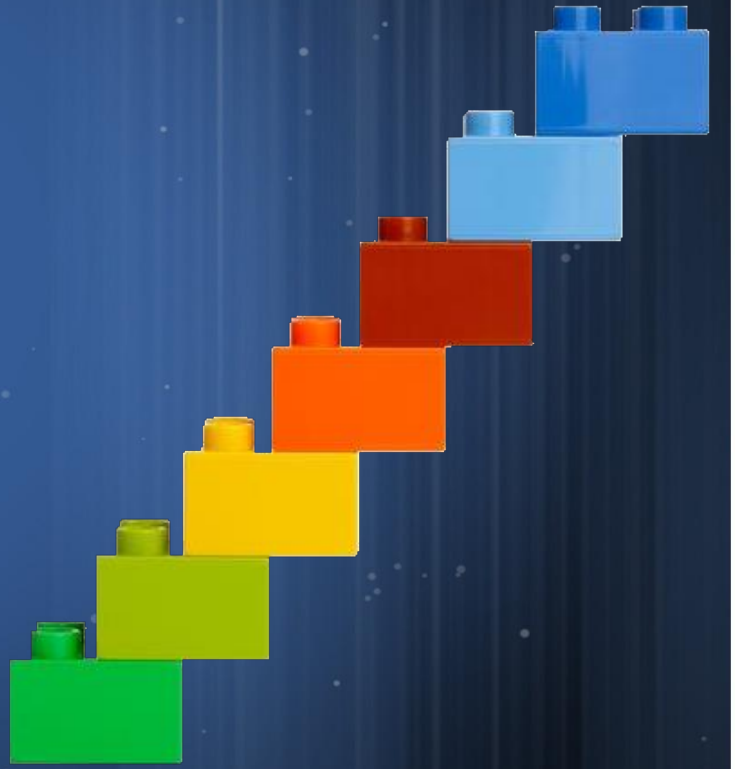
“Smart” RGB at the core of the display

What makes them smart?



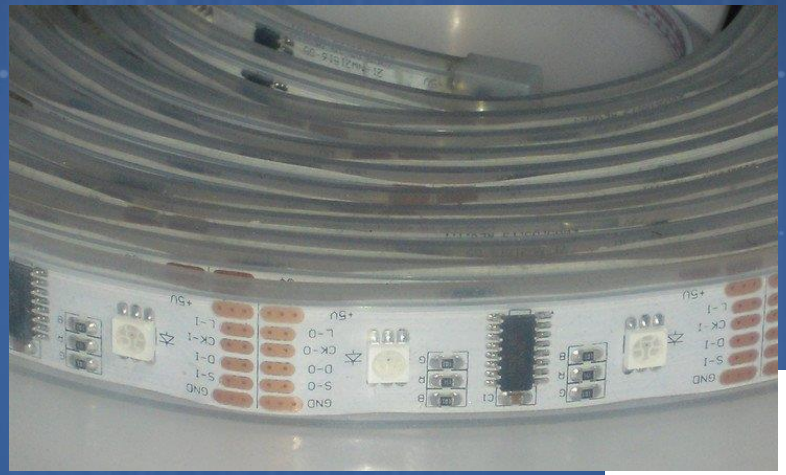
Pixels: WS-2812b serial protocol

- Simple protocol
- Indefinite length strings*
- Reshapes pulses at each pixel

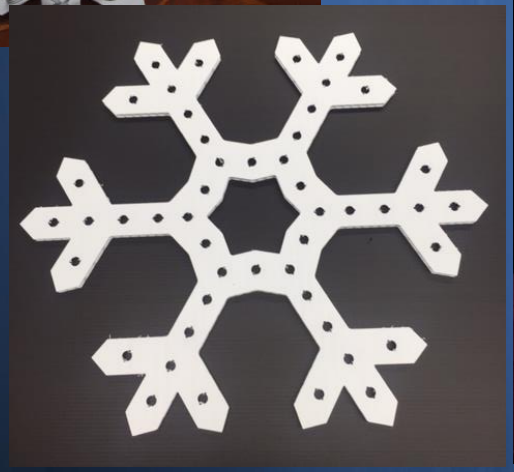


Many form factors for LEDs

Customize: cut and solder



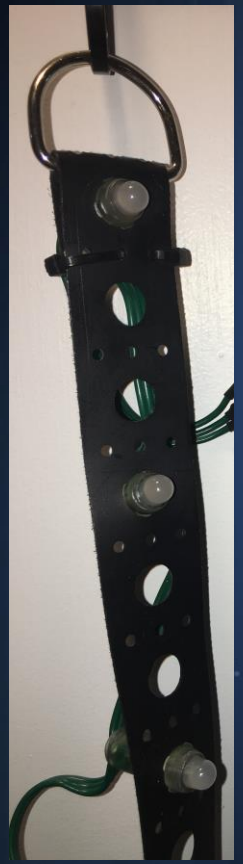
Custom Elements

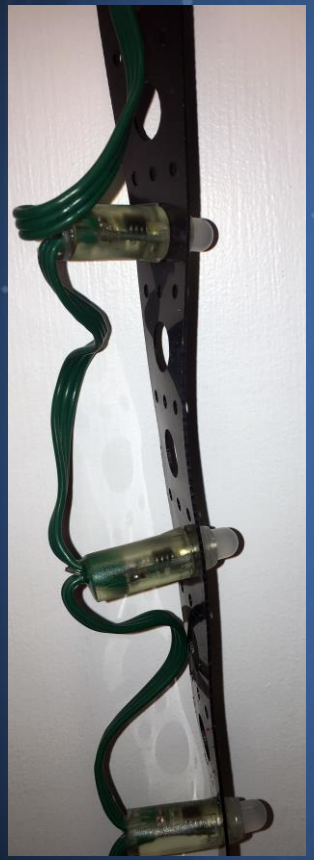


Mega Trees

- Matrix made of Pixel Strings
- Pictures, Animations, Effects
- Low resolution
- Example: 50x32 pixels, 14 feet tall
- Dominate the scenery

Mega Tree





Flood Lights

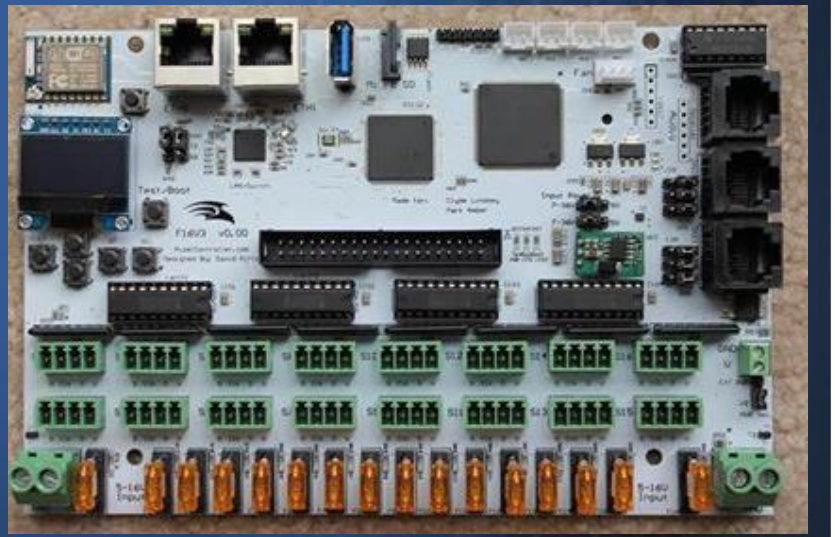
- Round out the display
- 10-30 Watts
- “Color Wash” Walls & Trees

Ethernet Control of Pixels

- Streaming-ACN (E.131) Protocol
- ACN- Industry standard suite of protocols for lighting and control via Ethernet
- Subset for "lightweight" devices called sACN (E1.31)
- UDP: Unicast to a single IP or Multicast
- Groups up to 512 channels in “Universes”

Controller

- Ethernet to pixels
- Power and Fusing
- Remapping
- Testing Pixels
- Good controllers have web based interfaces



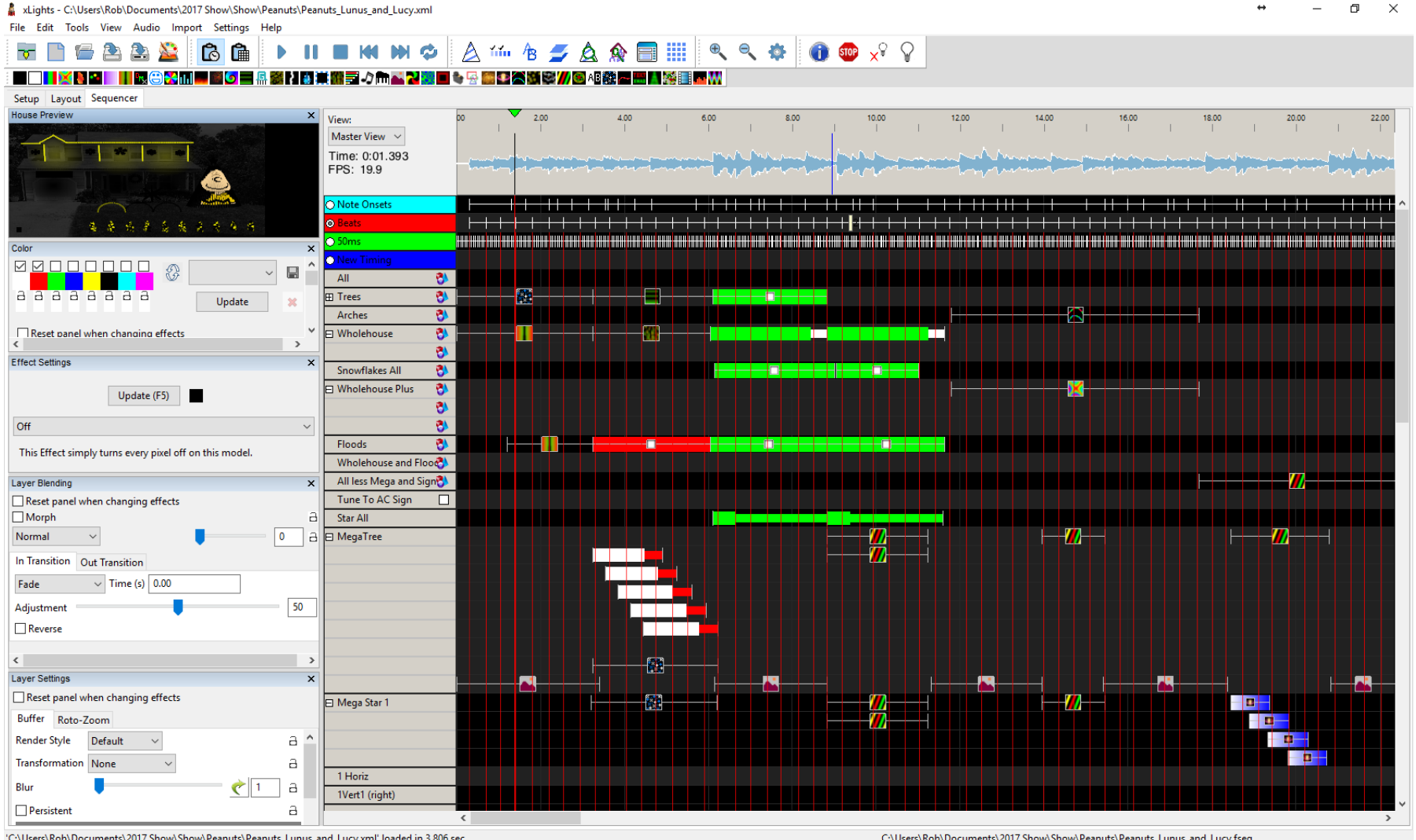
Running the show

- Dedicated computer
- Starts lights on schedule
- Streams data to controllers
- Two popular options:
  - Windows PC
  - FPP Falcon Player- Raspberry PI

Sequencing

- Light show events aligned to music
- Millisecond control of lights
- Apply effects across one or more elements
- Computing complex visual patterns
- Simulates the show without hardware

- Free and commercial sequences can be adapted


xLights - C:\Users\Rob\Documents\2017 Show\Show\Peanuts\Peanuts_Lunus_and_Lucy.xml
File Edit Tools View Audio Import Settings Help
Setup Layout Sequencer
House Preview
Color
Update
Reset panel when changing effects
Effect Settings
Update (F5)
Off
This Effect simply turns every pixel off on this model.
Layer Blending
Reset panel when changing effects
Morph
Normal
0
In Transition Out Transition
Fade
Time (s) 0.00
Adjustment
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Reverse
Layer Settings
Reset panel when changing effects
Buffer Roto-Zoom
Render Style Default
Transformation None
Blur
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Persistent
View:
Master View
Time: 0:01.393
FPS: 19.9
Note Onsets
Beats
50ms
New Timing
All
Trees
Arches
Wholehouse
Snowflakes All
Wholehouse Plus
Floods
Wholehouse and Floo
All less Mega and Sign
Tune To AC Sign
Star All
MegaTree
Mega Star 1
1 Horiz
1Vert1 (right)
'C:\Users\Rob\Documents\2017 Show\Show\Peanuts\Peanuts_Lunus_and_Lucy.xml' loaded in 3.806 sec
C:\Users\Rob\Documents\2017 Show\Show\Peanuts\Peanuts_Lunus_and_Lucy.fseq

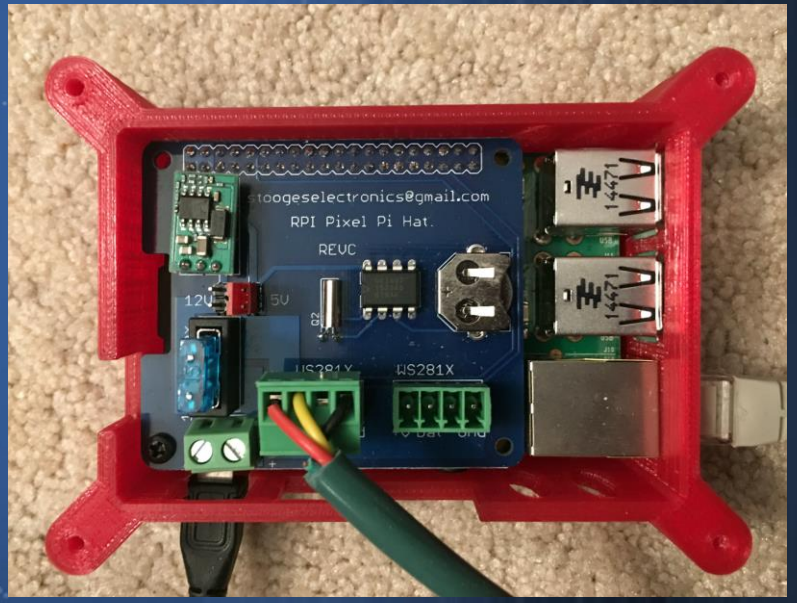
Raspberry Pi Pixel Driver

- Software library- Generate pixel serial data
- GPIO pin 18 – direct drive
- 3.3V data output
- WS-2811/2812 pixels expect 5v
- Works, but suboptimal

Raspberry Pi Pixel Driver

Better than direct drive:

- Buffered outputs
- 12V and 5V pixel options
- Two strings of 800+ pixels
- Bonus: real time clock



Buying Pixels

- Direct from China
- “Pre-sales” – group buys
- eBay and Amazon
- Specialty Sellers

Consider form factor and voltage (5V/12V)

Matrix Displays

P10 Panels (10MM Pixels)

Beaglebone Adapter – up to 64 P10 panels

Raspberry Pi Adapter – up to 12 P10 panels

Software: FPP Falcon Player

Water is the Enemy

- Buy weather rated lights
- Clear Silicone Caulk to seal strip ends
- Weatherproof connectors
- Electrical enclosures:
  - CG-2000 cable boxes
  - Tackle boxes
  - Ammo Cans
- Cooling can become an issue

Two challenges

- Voltage drop –
  - Can’t push enough current through small wire
  - White colors shade to Pink
  - Solution: Voltage injection. Power at both ends of string
- Distance to first pixel
  - Signal corruption
  - Solution: “Null pixel” – reshapes signal.

Broadcasting

- Controller outputs audio
- FM radio station for viewers
- Find an open channel to avoid interference
- https://radio-locator.com/
- Antenna makes a significant difference
- Challenge: clear signal within FCC rules

Skills

- Soldering
- Debugging
- Planning
- Logical thinking
- Creative and artistic design
- Attention to detail

Clip of Xmas lights: Star Wars

Christmas Light Resources:

https://goo.gl/tJjNs4