InteL-E-Ds

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A Lightshow for Me?

- NewVision-Tech
- CUBEecho
- Cheaper, Inferior alternatives
What’s Missing?

- None/Poor beat detection
  - Poor microphone
- Linear Cost Scalability
- Private devices rarely used
- Interface
We can top it:

- Comfortable Integration
- Accurate Music Analysis
- For club and personal use
The InteL-E-Ds Solution

- LED Music Controller
  - Sophisticated Music Analysis
  - App Interface
  - Plug & Play
  - Controls variable number of LED Modules
Requirements

- Easy to set up
- Seamlessly stream music
- Aesthetic Case
  - Small, Sturdy Enclosure
- Intuitive App
Specifications

● Stream standard format music

● Recognize beat, key, mood in real time
  ○ Control light modules accordingly

● App to control lights and stream music
Design Alternatives

- Input Types: Aux / Airplay / Volumio / WiFi / Bluetooth
- Processor: BBB vs DSP vs Higher End
- Supported Modules: LEDs / Lasers / Speaker / Fog
Block 1:

Input:
- Standard format music file
- LED configuration

Output:
- Music file over airplay
- Light Control Signals
Block 1: work plan

App

music file

Volumio Out

Control
Block 2:

Input:
- song
- file
- live

Output:
- array of FFT samples
- song.wav
Block 2: work plan

songToWav 

song file via wifi 

songToWav 
song.wav 

toArray.c 

N-Pt FFT.c 

send [1xN] array of .1 sec of music 

Iterate over i segments of music 

Linux Libraries 

.1 sec buffer 

bluetooth transmitter 

Bluetooth receiver 

Bluetooth 

receiver
Block 2: work plan

1. **16-bit sound card**
   - Record via sox

2. **toArray.c**
   - Iterate over $i$ segments of music
   - Send [1xN] array of .1 sec of music

3. **N-Pt FFT.c**

**Diagram:**
- Song via Aux
- Bluetooth transmitter
- Bluetooth receiver
- Aux 16-bit sound card
- bluetooth buffer
- sox
- Bluetooth receiver
Block 3:

Input:
- Freq Arrays Over Time
- Arrangement of Modules

Output:
- Light Display According to
  - Beat presence
  - Dominant Key
  - Mood
Block 3: work plan

Beat Detection:

- FFT #2
- Peak detection
- Low Frequencies
Block 3: work plan

Dominant Key Detection:

- Popular Chords
- Freq to most matching chords
- Chord positions => Key
Block 3: work plan

Mood Detection:

- Psychology keys => mood
- Frequency => color
- Color => mood
Block 4:

Input Requirements:
- Accept noisy 12V supply from cheap adapters
- Maintain stable 2.4GHz Bluetooth connection
- Firmware must support custom lighting protocol
- Any Bluetooth 4.0+ device can interface (phone, tablet)
- Buttons for manual “mood lighting” input
- IR receiver for additional control (“stretch goal”)

Output Requirements:
- 4 Channel 12V LED strip output
- 4 350mA constant current outputs
- At least 10bit & 1kHz PWM

Physical Requirements:
- Accept 2.1mm 12V barrel jack (ubiquitous in consumer elec)
- Enclosure doesn't greatly attenuate 2.4GHz signal
- Rugged enough for 4ft drops
- Water resistant
Block 4: Alternatives - CPU

- Low frequency proprietary radio - 915MHz
  - Greater indoor signal penetration
- BlueGiga Scripting Module or equivalent
  - Already FCC certified
  - Scripting language is primitive
  - Not suited for mass production
- T.I. BLE SoC - CC2540, with 8051 uC
  - ARM Cortex is more modern and more powerful
  - Nordic nRF51822 SoC is better suited
Block 4: Alternatives - Output

- Power LEDs with spotlight lenses
  - Excellent lumen density
  - Difficult thermal constraints
  - Difficult to diffuse light indoors (worse when dim)
- 12V LED Strips
  - Excellent optical and thermal diffusion characteristics with proper installation
  - Mass market penetration removes burden of production from small startup company
  - Difficult to install and remove
Block 4: MDR Deliverables

- nRF51822 based system interfacing via BLE
- Clean 12V power supply
- 4 Channel PWM output
- 4 Channel 12V drivers
- 1 Channel Relay driver (fog machine etc)
MDR deliverables

- Send song to BBB from app
- From song to FFT array
- Beat Detection
- Lights blink to beat of song
Questions?
PARTY MODE: Off

Setup Party Mode
Load Playlist: Select
Allowed Brightness:

FOG: BLAST
My Visuals

- LED Strips: 16
- Power LEDs: 4
- Fog Machines: 0
- Lasers: 0
- Monitors: 0
- Other Devices: 0
Configuration

LED Strips:
- [ ]
- [x]
- [x]

Power LEDs:
- [x]
- [ ]
- [ ]

Fog Machines: