GOALS

Create possibility for users without embedded systems programming skills to create and configure “light effects” using LED strip and developed API running on microcontroller.

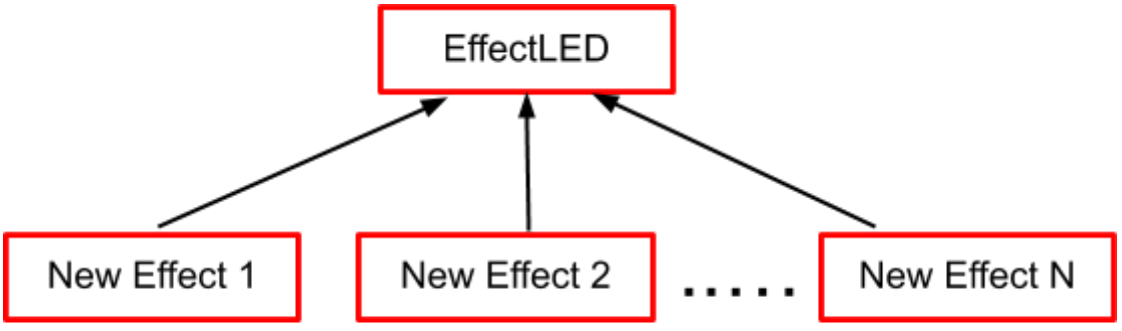
Actual existing open source solutions uses pre-configurable effects, so to modify any parameter (i.e. color, brightness, esc..) it is necessary make additional steps namely :

- interrupt execution of current program,
- create new source code or modify existing one,
- compile this new source code (debug if necessary),
- connect microcontroller to PC through one of possible interface,
- load the compiled code to the microcontroller,
- restart program execution.

The goal of our project is to provide to the end user possibility to interact with the executed program in order to change “light effect” parameters on the fly, i.e. without additional steps listed above.

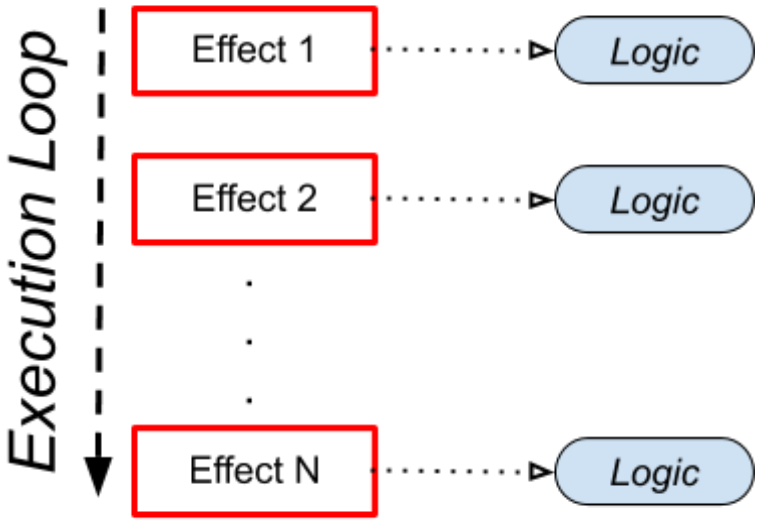
API

Every light effect has a set of parameters that can be configured using API provided by this effect. New developed effect must extend main *EffectLED* class, and implement set of the methods, where the most important is method run(), that define the main behaviour of this effect;



Execution Loop

During the program execution Effects may be called by the user, and consequently added to the *Effect List* of fixed size (10 at the moment). Each *Effect* in *Effect List* execute own *light effect* logic, successively, during defined interval (that may be different for each effect).



User Interaction

The main program process support set of the commands that allow to the user interact with *Effects* that are running (is on execution loop). Pre-configured Serial Port is used to communicate with microcontroller on real time. It is waiting for incoming instructions from the user and answers them. The minimal set of summoptred commands are listed below:

Command	Description	Example
new : Name	Add new light effect to execution loop	new : Runner
list :	Show all effects on effect list and assigned number	list:
del: num	Remove effect from execution loop	del : 1
set : num	Select and Configure Effect	set : 1
end:	Finalize Effect Configuration	end:

External Library

FastLED 3.1
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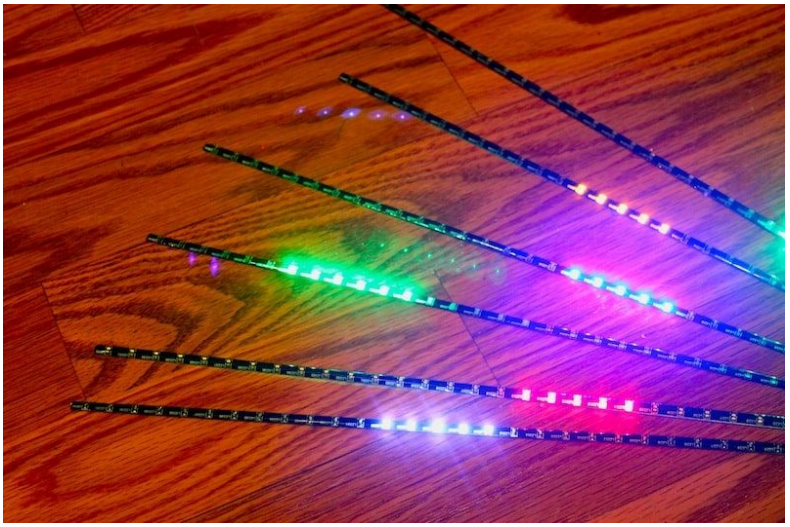
This is a library for easily and efficiently controlling a wide variety of LED chipsets, like the ones sold by adafruit (Neopixel, DotStar, LPD8806), Sparkfun (WS2801), and aliexpress. In addition to writing to the leds, this library also includes a number of functions for high-performing 8bit math for manipulating RGB values, as well as low level classes for abstracting out access to pins and SPI hardware, while still keeping things as fast as possible.

* Quick start for new developers (no need to think about specifics of the led chipsets being used)
* Zero pain switching LED chipsets (new chipset)
* High performance (high performance 8-bit math for RGB manipulation, and some of the fastest bit-bang'd SPI support around)

(https://gitter.im/FastLED/public)

Exemple Effect (Runner)

In order to evaluate our approach the example effect named Runner, was defined. it create the effect of light displacement through the LED strip. Example:



The set of configurable parameters was identified, so user can change tham during program execution through provided effect API. Basically, by changing this values user may configure effect, without direct reprogramming of microcontroller logic. By executing a “set” command Effect returns the actual values of parameters. After that user can set the value to the desired parameter, observing the changes in real-time.

Parameter	Description	Range	Example
color	The color represented in RGB format	000000 - FFFFFF	color : 00FF00
period	time in ms light between displacement	>= 0	period : 100
brightness	brightness of leds used in effect	[0:255]	light : 50
size	number of leds used in effect	[0:; MAXL]	size: 5
numLeds	number of positions assigned for effect	[0;MAXL]	numl : 10

CLI

To test the developed API we create CLI (command Interface) to interact with the user. The table below represent example of those interaction

Seq	User Command	Response
1	new :	New Effect : Runner 0, inserted into position : 0
2	new :	New Effect : Runner 1, inserted into position : 1
3	list :	All running effects effects : [0] Runner 0 [1] Runner 1
4	set : 1	Configuring : Runner 1 Runner 1 List of configurable Values:>> numl = 31 period = 100 size = 1 color = FFFF00 light = 50
5	size : 5	Runner 1 >> size : 5
6	period: 500	Runner 1 >> period : 500
7	color: 00FF00	Runner 1 >> color : 00FF00
8	end:	SET is Done
9	del:0	0 is deleted
10	list:	All running effects effects : [1] Runner 1