A Proposal to Develop a Wirelessly Controlled Visual Indicator Embedded System

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# Introduction

This project will take the form of a hardware and software implementation. The hardware will consist of an ATSAMC21-family microcontroller connected to a daisy chain of WS2812B smart addressable RGB LEDs as well as to a NRF24L01+ 2.4GHz wireless transmitter and receiver. The software will consist of routines using the microcontroller provided serial communication interfaces (SPI) to communicate with both devices and set the visual displayed on the LEDs based on the input received on the wireless interface. Messages will be sent to the device from another microcontroller—wireless pair to control the display.

# Requirements

Informal requirements include being able to run for an hour on standard batteries with a quarter of the LEDs illuminated.

* Purpose: Display different visuals in response to selected values
* Inputs: Wireless messages
* Outputs: LED light array with 200 lights
* Functions: Select between 5 visuals for display; low battery warning
* Performance: Update display within 50ms from user input
* Manufacturing Cost: Final assembly should be <$40
* Power: 1500mA
* Physical Size and Weight: An assembly would be smaller than 190mm x 190mm.

# Specifications

## Conceptual specifications:

* The remote shall have two primary buttons: up and down
* A button shall interrupt the remote CPU
* On a button press, the remote shall transmit a wireless message
* The wireless message shall contain a 1-byte address representing the intended receiver and a 1-byte identifier representing the button pressed
* The receiver shall check for incoming messages through an interrupt
* Upon receiving a valid message, the display controller shall cycle forward or backward through visuals
* The controller shall periodically update display based on current state

## Block diagram

Remote

Display Controller

CPU

Battery

Buttons

Transponder

CPU

Transponder

Battery

LEDs

## Components

* CPU: ATSAMC21J18A-AUT
* Transponder: NRF24L01+
* Remote battery: CR2032 3V primary lithium button cell
* Controller battery: PKCELL 3.7V Lithium-Polymer battery at 2500mAh / 10Wh
* LED: WS2812B Rev5

## Detailed Specification

LEDs

Reset()

Shift(R,G,B)

Transponder

Byte[] Read(cmd, length)

Write(cmd, data[], length)

Controller

Int cur\_visual

Interrupt()

Update-State()

Set-Output(vis)

Remote

Interrupt()

Read-Buttons()

Send-Message()