AstroPlant Multi-spectral Imaging

LED PCB specifications

Introduction

The NDVI (Normalized Difference Vegetation Index) gives a very rudimentary value for the amount of live vegetation (and the quality of the vegetation up to some point) contained in a certain portion of an image.

It is defined as follows:

$$NDVI = \frac{R_{NIR} - R_{Red}}{R_{NIR} + R_{Red}}$$

Where Rx is the reflectance (the ratio between incoming and reflected light) of a certain spectral band X. Values lie between −1 and 1 and typical values for vegetation are between 0.3 and 0.8. Other mass in the photos will tend to have a lower NDVI. To measure the NDVI for AstroPlant a custom light panel prototype was developed. The reason for this technique is that AstroPlant kit's are enclosed systems, which in turn sets the stage to specifically turn LED's with a specific wavelength on or off. This control over actuators resulted in a different method for calculating NDVI as opposed to traditional NDVI measurements that uses sunlight. For more details about the research & development done for multi-spectral imaging please contact the AstroPlant team for the full report. This document focuses mainly on the development of production ready LED panels required for achieving NDVI imaging in AstroPlant kit's.

Overview LED panels

Two LED panels are required with the same amounts of LED's in which the LED's are controlled by a transistor. The transistor should make use of the 5V pin output of the AstroPlant extension board. The transistor is not needed on each PCB, as all LED's could be controlled by a single transistor. Hereby we propose two options:

- OPTION 1 [driver PCB & two LED Panels]: This option has a dedicated PCB for the driver containing a connector for the two LED panels.
- OPTION 2 [LED panel with driver & one LED panel without driver]: This option denotes a 'master' LED panel that has a driver and a 'slave' LED panel that is connected with the 'master' panel. The 'slave' drive should have in this case a placeholder for a driver such that a single design should suffice. Potentially jumpers may be used to determine of the panel should act as a 'slave' or 'master'. This option is the preferred option.

For ease of use of the existing hardware architecture it would be beneficial to select a driver that can be actuated with I2C. The AstroPlant extension board has open sockets for 5v and 3.3V I2C connections.

Overview components per LED panel

1. 1x red LED (660-680 nm, ~15 mA)
2. 1x nir LED (850 nm, ~15 mA)
3. 1x white LED (~400-700 nm, ~20 mA, cool or warm)
4. Resistors
5. 1x driver/transistor array (Optional, in case option 1 is used an additional PCB is needed)

Component links (not fixed, choose other vendors if desired)

Component	Link [examples]
# 1	https://nl.mouser.com/
# 2	https://nl.mouser.com/
# 3	https://nl.mouser.com/
# 4	Local vendor
# 5	http://www.ti.com/product/