Abstract

The evolution of open source software and hardware has enabled end users to develop custom tools for problems where commercial solutions are either not available or are insufficient. The Lead Identification group has leveraged these open source tools to develop a custom open source LED array capable of illuminating 96- and 384-well microplates to address a number of challenges in the laboratory. This custom LED array based platform, known as the Microplate Assistive Pipetting Light Emitter (M.A.P.L.E.), can be used to support manual plate-to-plate cherrypicking processes, provide visualizations in microplates for training purposes and lab tours, provide user-controlled custom color illumination when handling light sensitive compounds, provide backlighting for well artifact illumination, and to provide stroboscopic illumination for liquid dispensing QC. The M.A.P.L.E. platform consists of custom LED arrays combined with the Arduino microcontroller and was designed to be extensible to meet future needs. Future possible applications include use in photochemistry and modification for use with different wavelength LEDs (e.g. UV) to extend its functionality.

Limitations of Existing Solutions

A number of systems exist which can be used to illuminate microplates, but they are limited in the following ways:

- Cost ($1,000+)
- Lack ability to track samples between multiple microplates
- Large form factor
- Not extensible
- Limited ability to integrate software with existing Laboratory Information Management System (LIMS)
- Limited vendor support – some products already deprecated
- Limited to fixed wavelength LEDs or tablet screens for illumination

Gen 2 improvements:

- Full user control of color for each individual LED
- Simplified electronics control scheme (single I/O line controls all LEDs)
- Improved programming via Adafruit NeoPixel library
- Portable battery powered option

Conclusion

The M.A.P.L.E. platform has proven to be effective in facilitating several processes in the HTS lab. The open source nature of the project allows for the illumination panels to be repurposed or modified for possible future applications such as use in photochemistry or applications which have specific wavelength requirements (e.g. UV). 

Additional Example Applications for Microplate Illumination

- Stroboscopic illumination for liquid dispense QC
- Multi-well illumination for serial dilutions
- Laboratory training
- Illumination of artifacts in microplates

M.A.P.L.E. is open source and available on GitHub:
https://github.com/pierrebaillargeon/Microplate-Assistive-Pipetting-Light-Emitter

Additional information can be found in the following publications:
- Baillargeon P, Spicer TP, Scampavia L – Applications for Open Source Microplate-Compatible Illumination Panels, JoVE. 2019 October. PMID 31633701

Example Applications for Microplate Illumination

- Finished Prototype Cost: ~$100
- Development of 2nd generation light panel replaced fixed wavelength through-hole LEDs with surface mount RGB LEDs
- Ability to easily adjust CAD models and 3D print prototypes allowed rapid testing of enclosure ergonomics
- Multi-well illumination for serial dilutions