Emissive Display Technology in Aerospace Applications

STUDENTS: Enrique Garcia, Brandon Ha, Sajid Khan, Stephen Macris, Jesus Ruiz, Rachel Samson, Chandler Wong

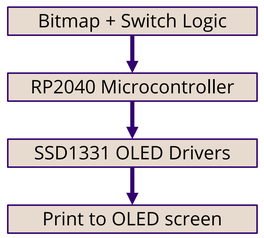
Emissive Display Technology

- Compared to traditional transmissive displays, emissive display technology has greater advantages such as an improved lifetime, wider viewing angles, and smaller form factor integration capabilities.
- Applying emissive displays within existing aircraft cockpit controls introduces an easily programmable and versatile display.
- New technologies can pave the way for incorporating more advanced display systems such as micro-LEDs.

System Design

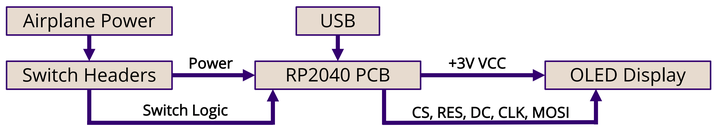
Software

- Programmed with Arduino IDE.
- Utilizes SSD1331 libraries to communicate to the display.
- SPI communication is utilized between the RP2040 microcontroller and the OLED.
- Switch logic drives connect to RP2040 GPIO.



Hardware

- The RP2040 microcontroller manages the display-user communication.
- Hardware implementation prioritizes necessary microcontroller functions.
- Power from the switch source supplies to the microcontroller and SSD1331 OLED.
- The microcontroller connects via USB, reading switch states from a physical module.

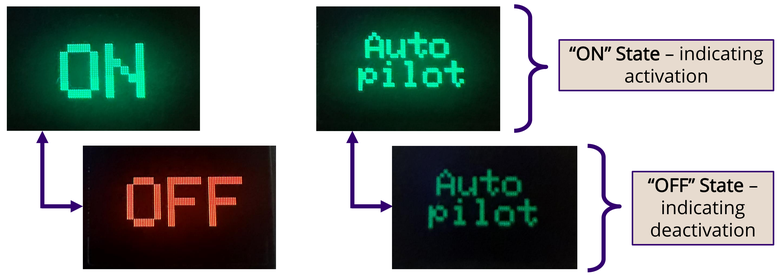


Korry Switch Model

- Utilizing the Korry 1380 LED momentary switch.
- Small form factor switch cap can be replaced for display electronics.
- Small PCB designs prevent switch part redesigns.

Software

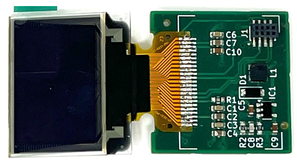
- Programmed custom text/image display on OLED using Arduino IDE.
- Utilized bitmap converter to control image pixels, downsizing for better display fit.
- Implemented push button behavior with “ON” and “OFF” state indicators, including screen messages and brightness adjustment.
- Display state changes through tapping or pushing mechanisms.



Hardware

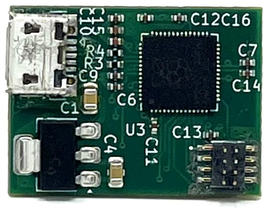
OLED Driver

The OLED PCB board includes:
- Display ribbon connections.
- Boost converter for display driving.
- Net routing for SPI protocols to the display.



Custom Microcontroller

The microcontroller strips down the standard development board to the essentials:
- USB connectivity via micro-b connector.
- 16 MB Flash Memory.
- 12 MHz Crystal Oscillator.
- 9 GPIO total with 5 GPIO using SPI controller.

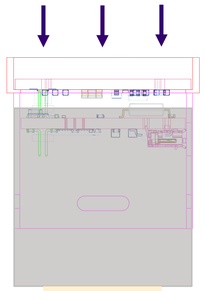


Adjusted Switch Cap

- Original model: Cap with spring base and LED backlighting.
- Our model: Spring base integrated, custom microcontroller inside cap, OLED Driver on top.
- Additional features: Transparent screen protection, USB access hole for programming.

Final Product

- The final product demonstrates an OLED display fully integrated into a Korry Electronics switch, supplied with power only through the switches' header.



- ✓ Laminated cover over OLED display
- ✓ OLED PCB mounted on the caps front cover
- ✓ Microcontroller board vertically mounted below the OLED
- ✓ 3D printed custom housing
- ✓ Power connections to switch base

- Fully housed and connected switch connected to external power. Able to properly display logical switch states assigned to it.

Future Work, References, & Acknowledgments

- Implement the micro–LED from Korry Electronics obtained through Play Nitride.
- Implement more software switch functionality and drivers.
- Update designs to be rugged for aerospace applications.

Industry Advisor: Kevin Parson
Faculty Advisor: Tai Chen
Students: Enrique Garcia, Brandon Ha, Sajid Khan, Stephen Macris, Jesus Ruiz, Rachel Samson, Chandler Wong

[1] Y. Wang, “Silicon backplane design for OLED-on-silicon microdisplay,” doi: https://doi.org/10.32657/10356/43518.

ELECTRICAL & COMPUTER ENGINEERING
UNIVERSITY of WASHINGTON

ADVISERS: Kevin Parson, Tai Chen

SPONSOR: Korry Electronics