

PROJECT BACKGROUND

After more than a century of research, wind induced crop failure remains an unsolved problem resulting in tens of billions of dollars in economic losses each year. Research from the University of Idaho is patenting tools that will allow plant breeders to develop crop varieties highly resistant to stalk failure.

DESIGN OUTCOMES

Plans for a commercially viable data acquisition platform were designed then sent to a contract manufacturer for assembly. The new embedded hardware improves upon the prototype devices, currently being used by the client, in a number of ways:

Requirement	Prototype Devices	Current Design
Reduced Assembly Time	20 hours of intern solder fun time	One-click orders through small-batch assembly
Reduced Cost	\$600 per board	\$150 per board
Better Data Acquisition	15Hz with 16-bit ADC load cell data	470Hz with 24-bit ADC load cell data
Improved User Input	Mechanical button input with delayed screen update rates	Resistive touchscreen with ms update rate
Quick Test Identification	Keyboard entry	Keyboard entry and barcode scanning
Increased Reliability	No ESD protection	IEC 61400-4 ESD protection
Easier Data Transfer	Obstructed SD card interface	USB bulk-transfer
Decreased Size	Two boards with 15 feet of cabling	One board ½ inch total height
Centralized Firmware Development	Raspberry Pi and Arduino based systems	PIC32 C based system with Github code repository
Expandable	Requires new PCB for additional circuitry	Robust options for daughter boards

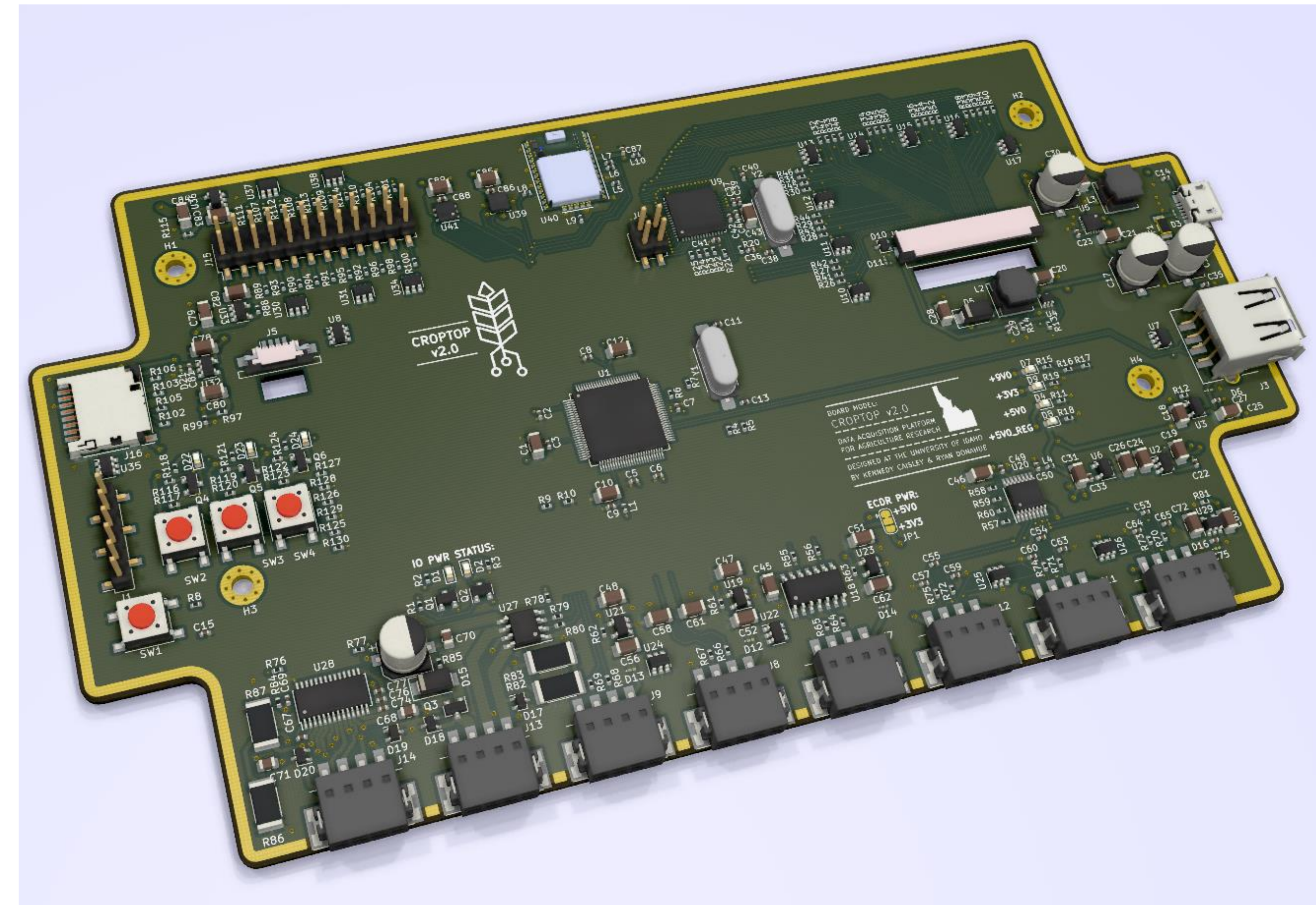


Figure 1: Rendering of CropTop PCB

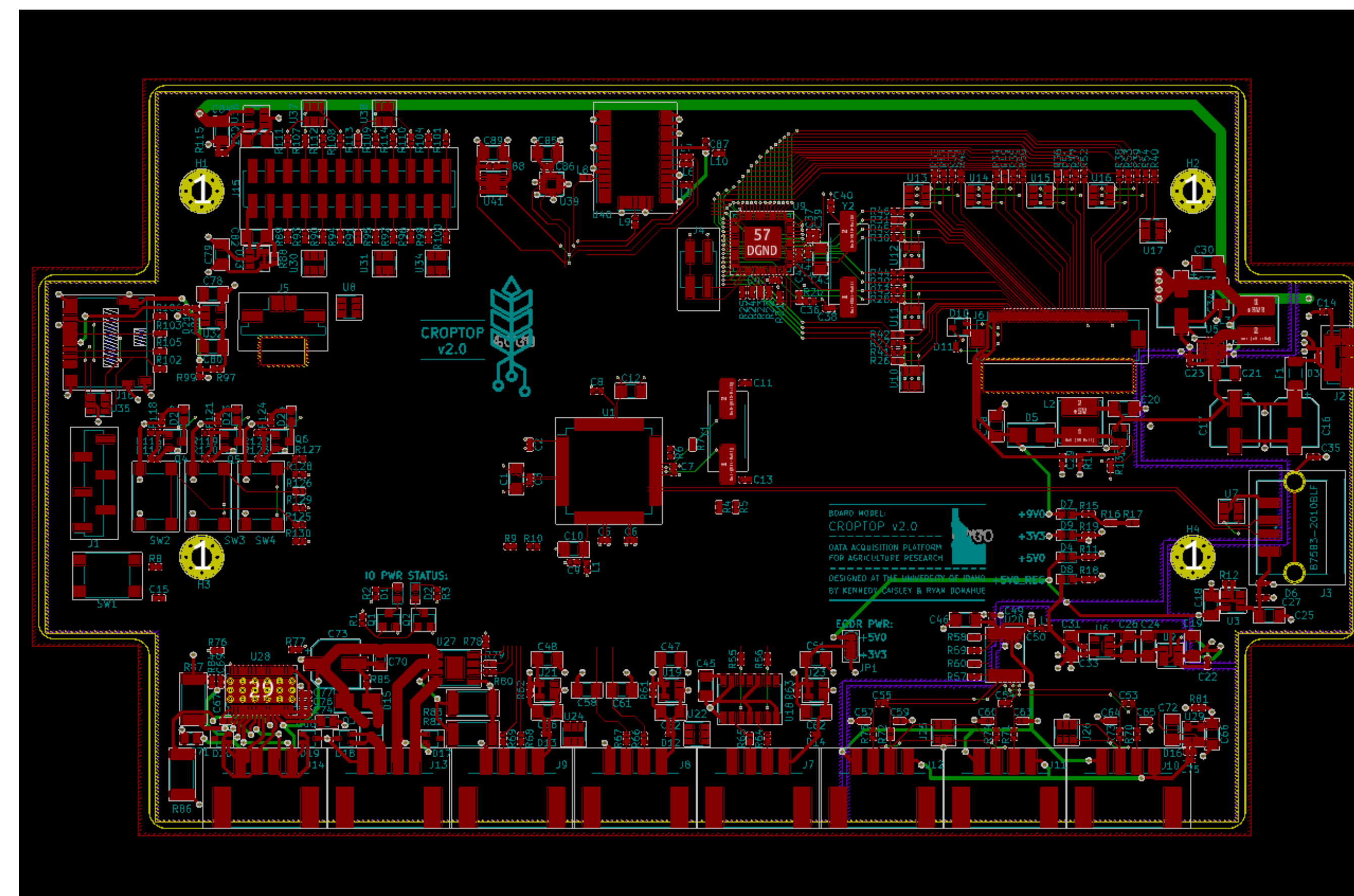


Figure 2: CropTop PCB Layout Gerber

FUTURE WORK

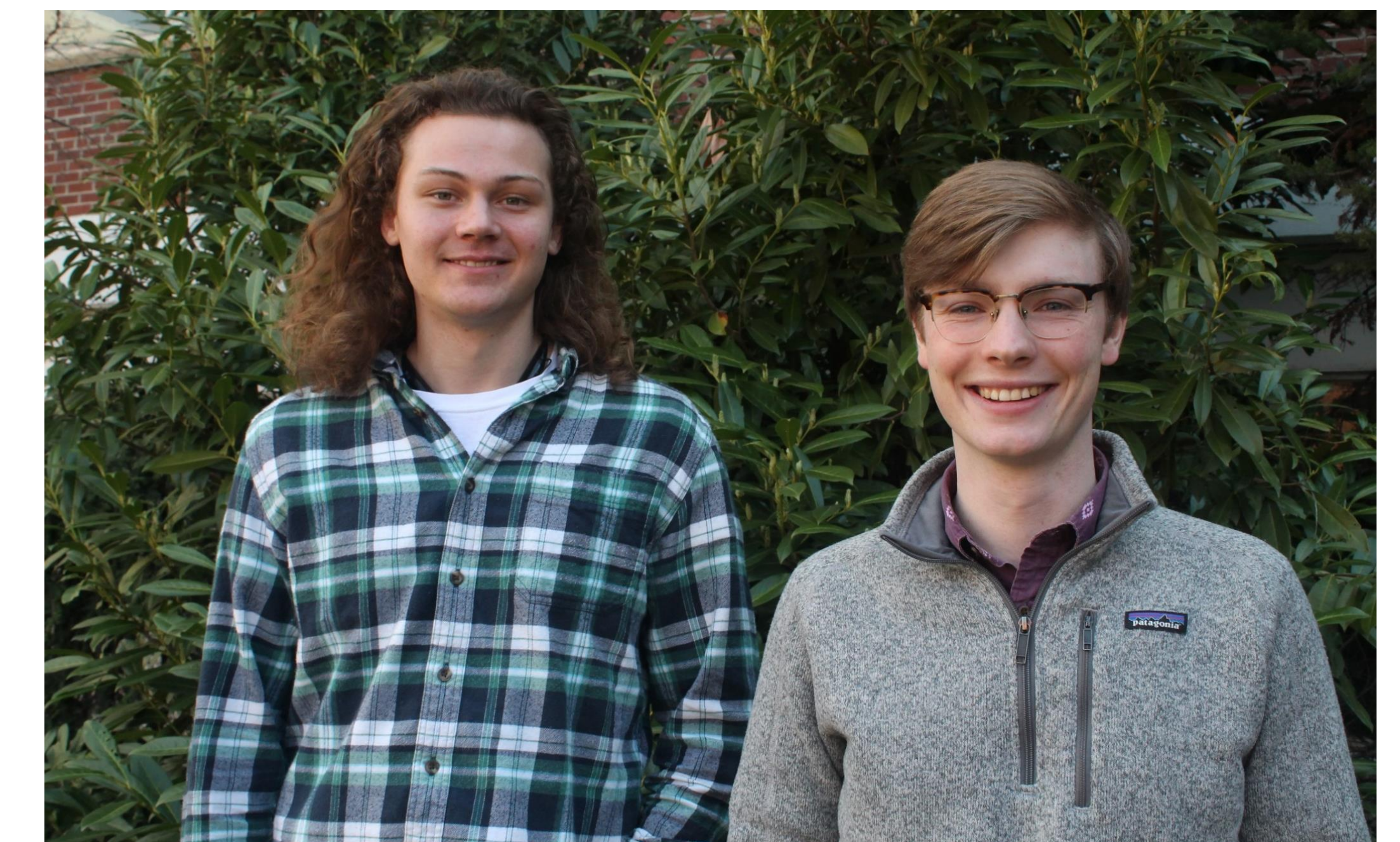
Create application software for existing devices using the newly developed hardware and device drivers found on the CropTop Github repository.

Link: <https://github.com/kcaisley/CropTop>

DESIGN FEATURES

- USB 2.0 Embedded Host for Bulk Data Transfer & Human Interface Devices
- Three 24-bit $\Delta\Sigma$ ADC Channels for Fluke Load Cell Force Measurements
- Graphic Processing Unit for 800x480 7" TFT LCD GUI Control and Resistive Touchscreen Feedback
- 160W DC Motor Driver for Linear Actuator Control
- SD Card for Non-volatile Embedded Data Storage
- Configurable 3.3V/5V Rotary Encoder Interface
- ADC for Linear Actuator Positioning Potentiometer
- GPS Receiver with Onboard Antenna for Time, Date, and Test Location
- Ultrasonic Ranging Module Interface
- Accelerometer for Tilt Measurement
- Temperature and Humidity Sensor
- Stepper Motor Controller

TEAM CROPTOP



Left to Right: Ryan Donahue and Kennedy Caisley

ACKNOWLEDGEMENTS

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