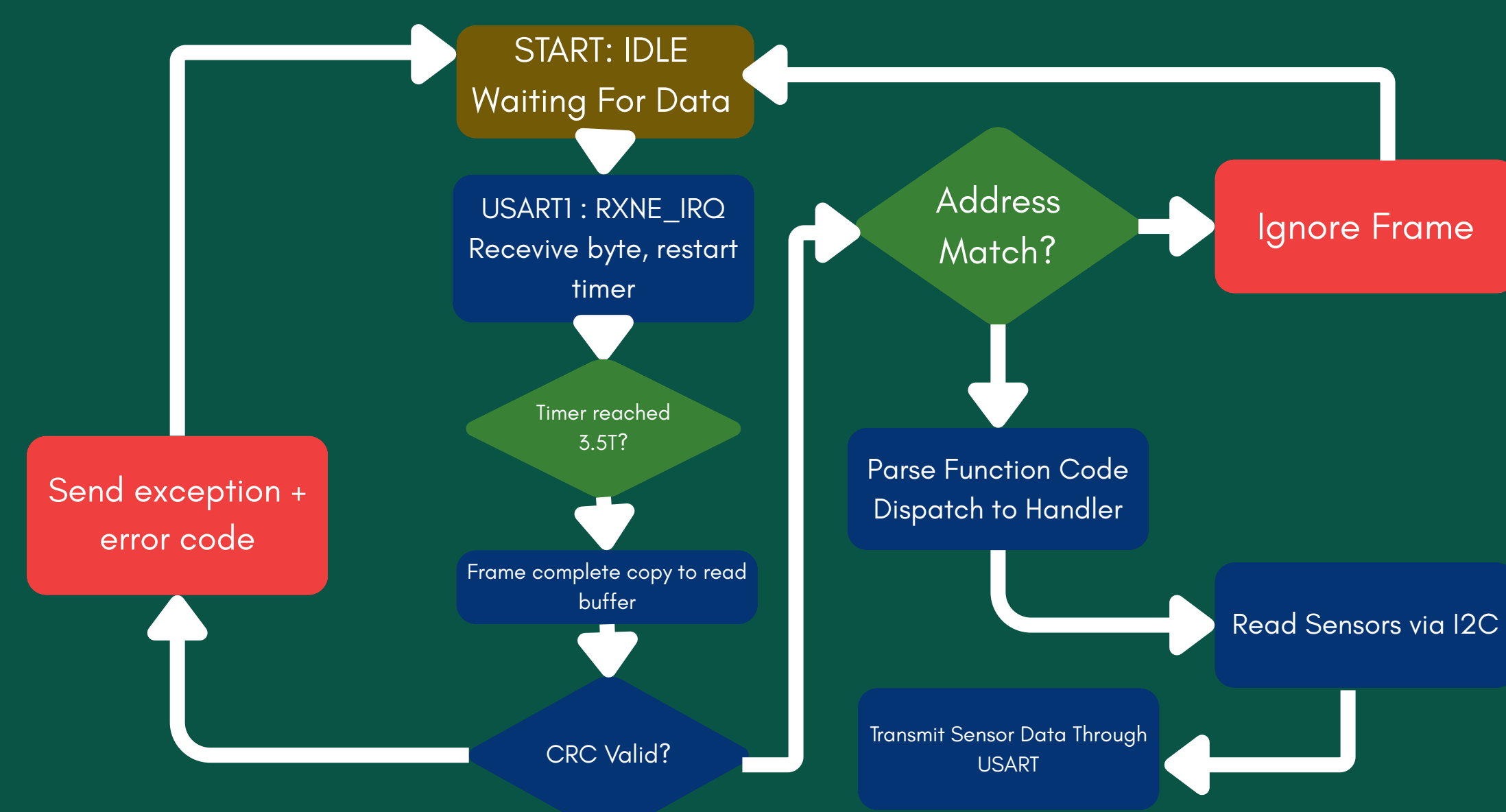


Background/Overview

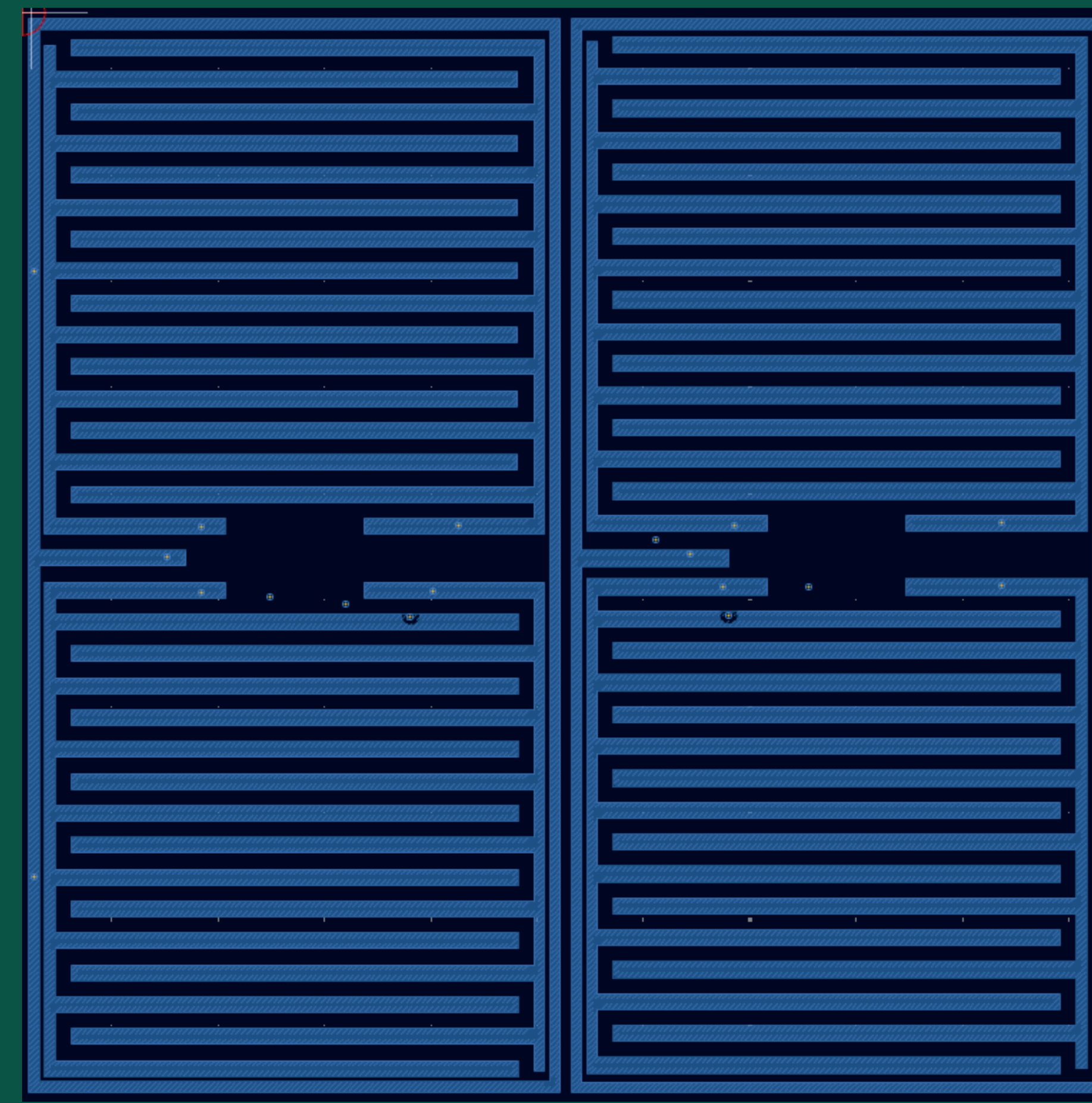


The sponsor for our capstone is Blue River Technology, a John Deere subsidiary innovating intelligent spraying systems. Blue River's flagship product, the See & Spray™, uses real-time visual analysis to differentiate crops from weeds and apply herbicide only where needed. Our project complements the See & Spray™ technology by designing a liquid coverage sensing system, providing precise feedback on spray distribution, sensor integration, and real time communication for improved accuracy in the field.

Firmware

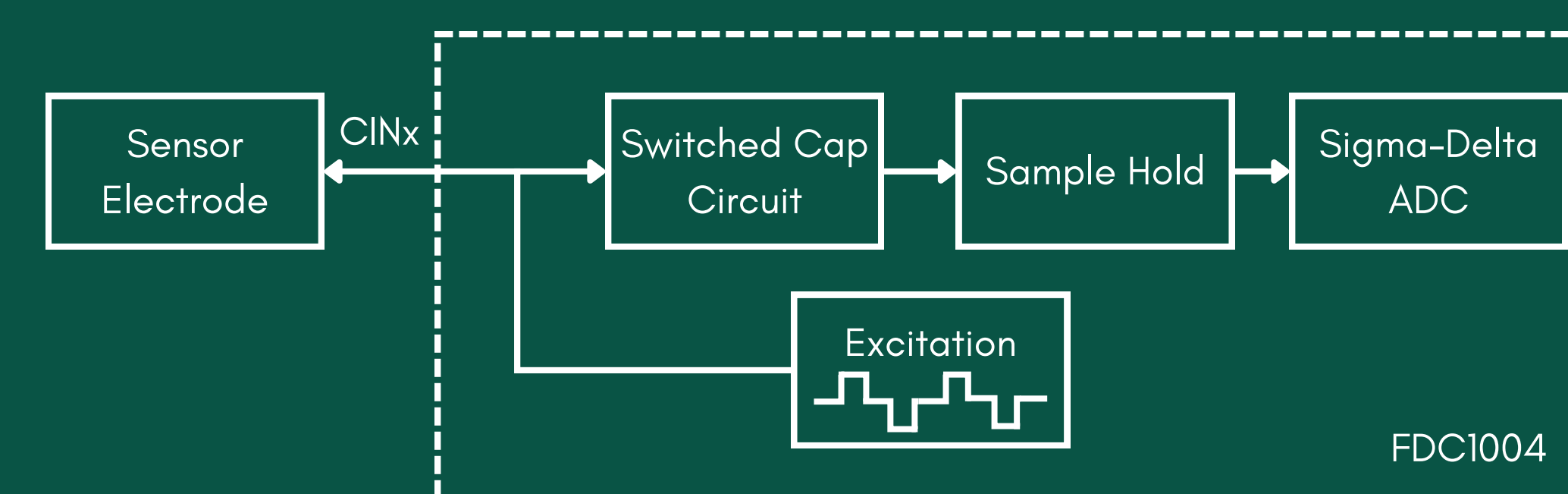


Sensor Geometry



The capacitive sensor board uses interdigitated comb electrodes to generate fringing electric fields that extend above the board. Capacitance increases with the amount of water present on the sensor surface. Shield rings direct the fields toward the surface, while Plexiglass layers tune sensitivity and penetration depth. The final board contains four 25 cm² sensing pads.

Capacitance-to-Digital Converter



The sensors are driven with FDC1004DGSRs from Texas Instruments. They drive the capacitor geometry and the associated shields and return a digital value for measured capacitance over the I2C protocol. These are responsible for all data values.

Hardware

JST Connectors:

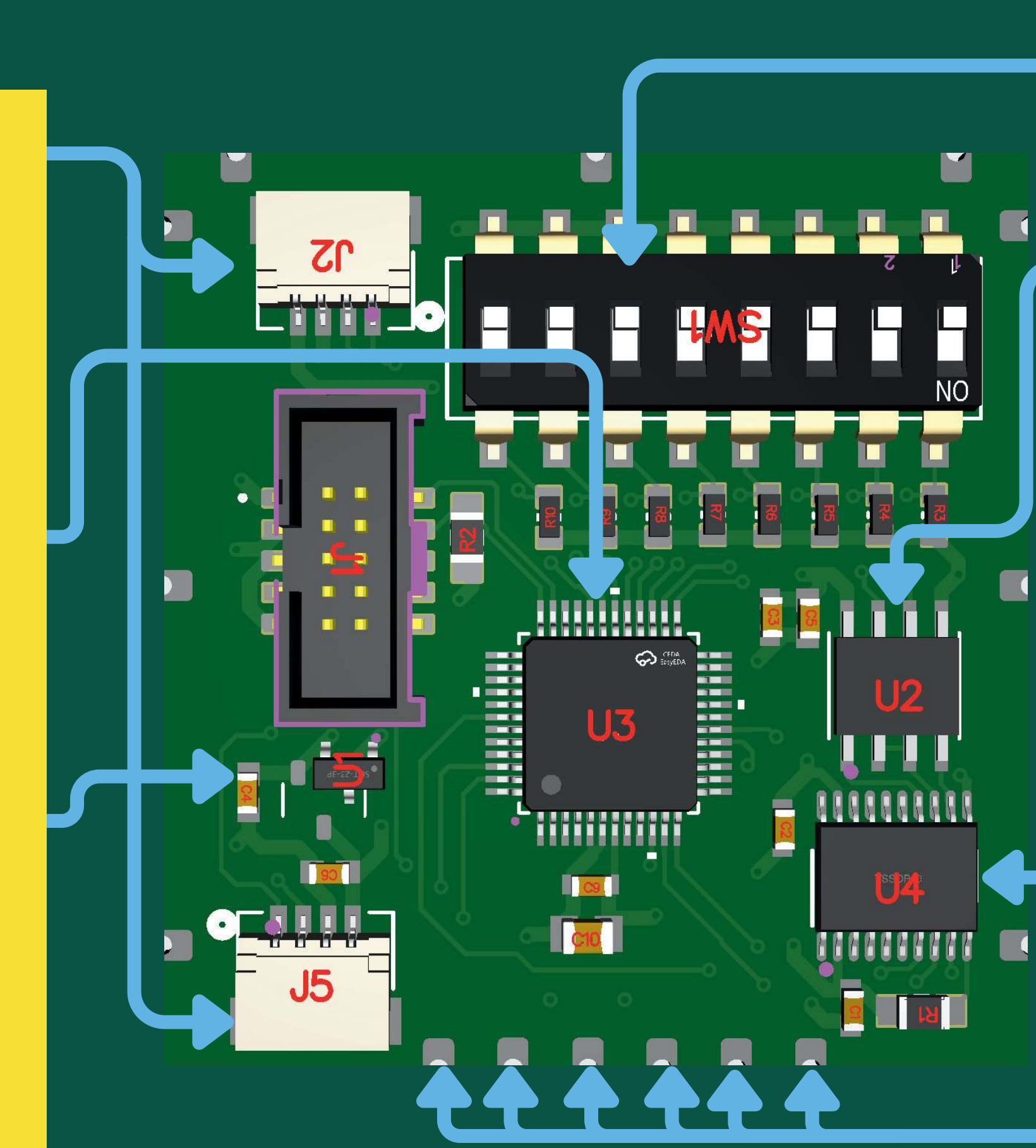
For daisy chaining power and data signals

Microcontroller:

Aggregates the sensor data

Linear Regulator:

Maintains constant 3.3V from daisy chained power rail



DIP-Switch: Used to set an address

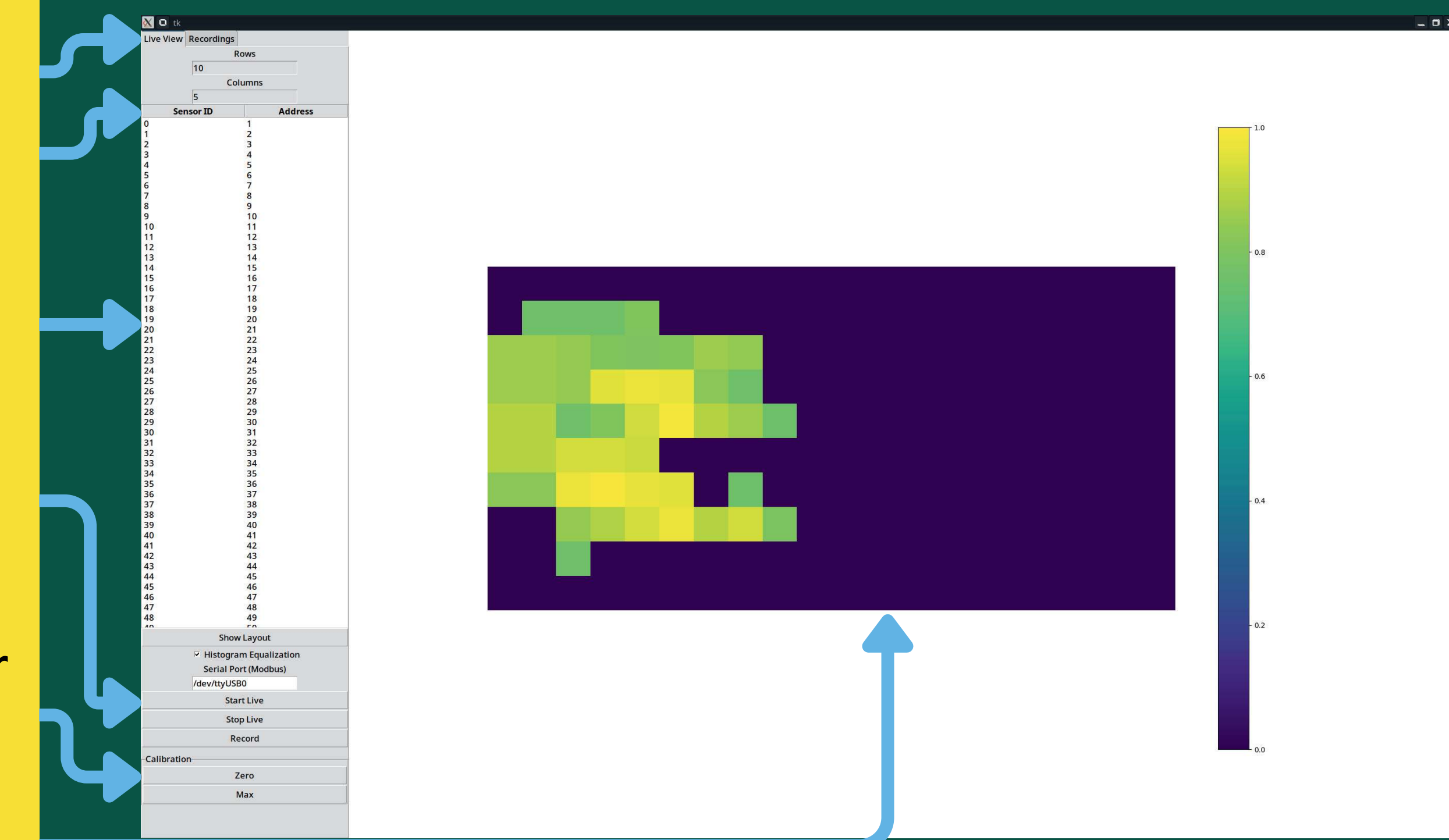
MAX+T Transceiver: Commonly used for RS-485

Level Shifter: Transceiver and STM communication in different voltage domains

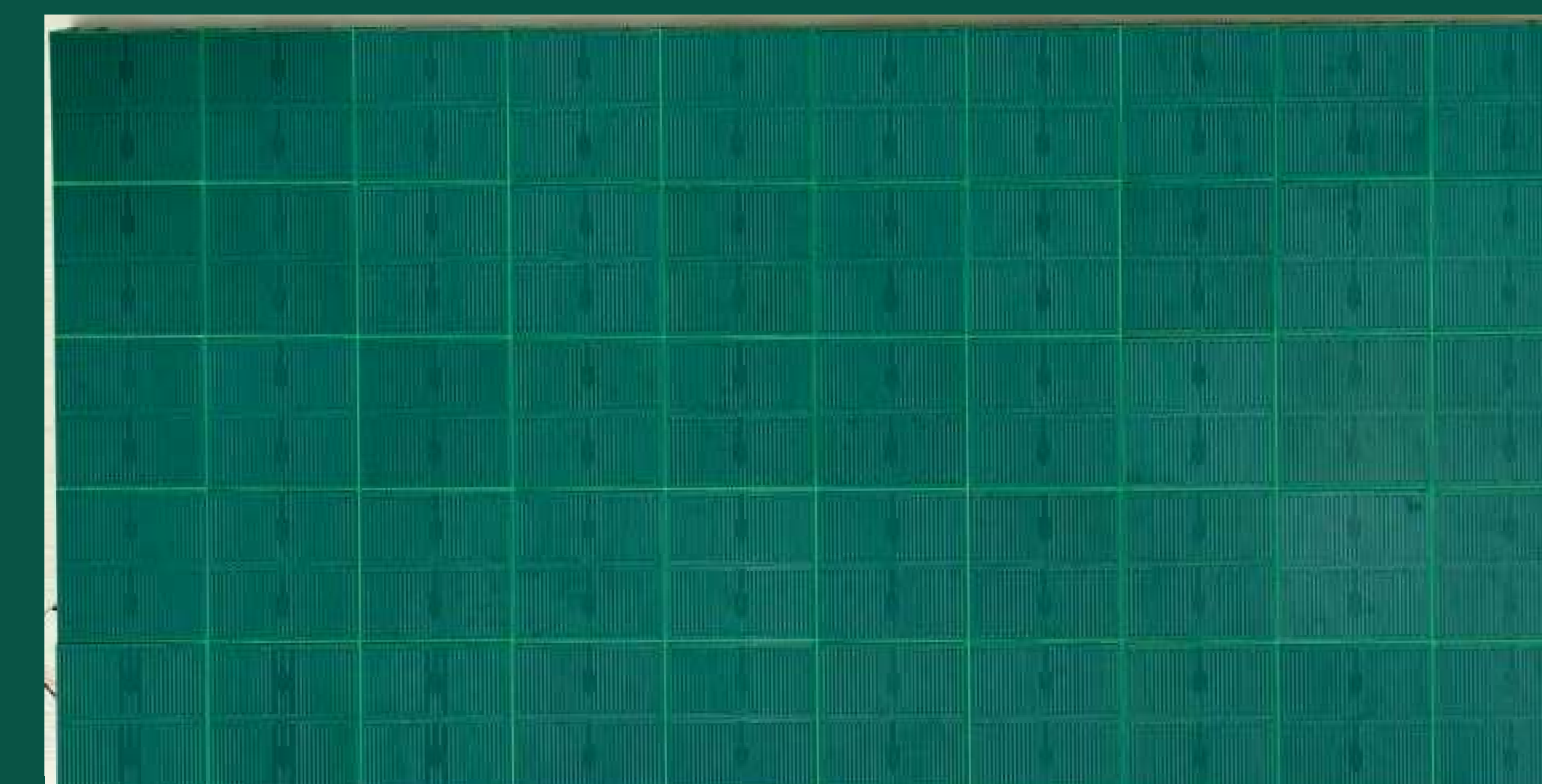
Castellations: Physical support/electrical connection

UI/GUI

- Live play back capabilities
- Control over sensor dimensions
- Manual addressing capabilities
- Recording toggle
- Histogram equalization
- Calibration capabilities for better dynamic range
- Real time sensor display



Block Diagram/Final Product



50 Automatic Sensing Systems are daisy chained to a CPU via JST-SH Cables. Each System is composed of 2 different PCBs. The main board houses the sensor geometry and ICs to measure data. The daughter board includes an STM to aggregate the data and communicate it to the CPU via the aforementioned JSTs.