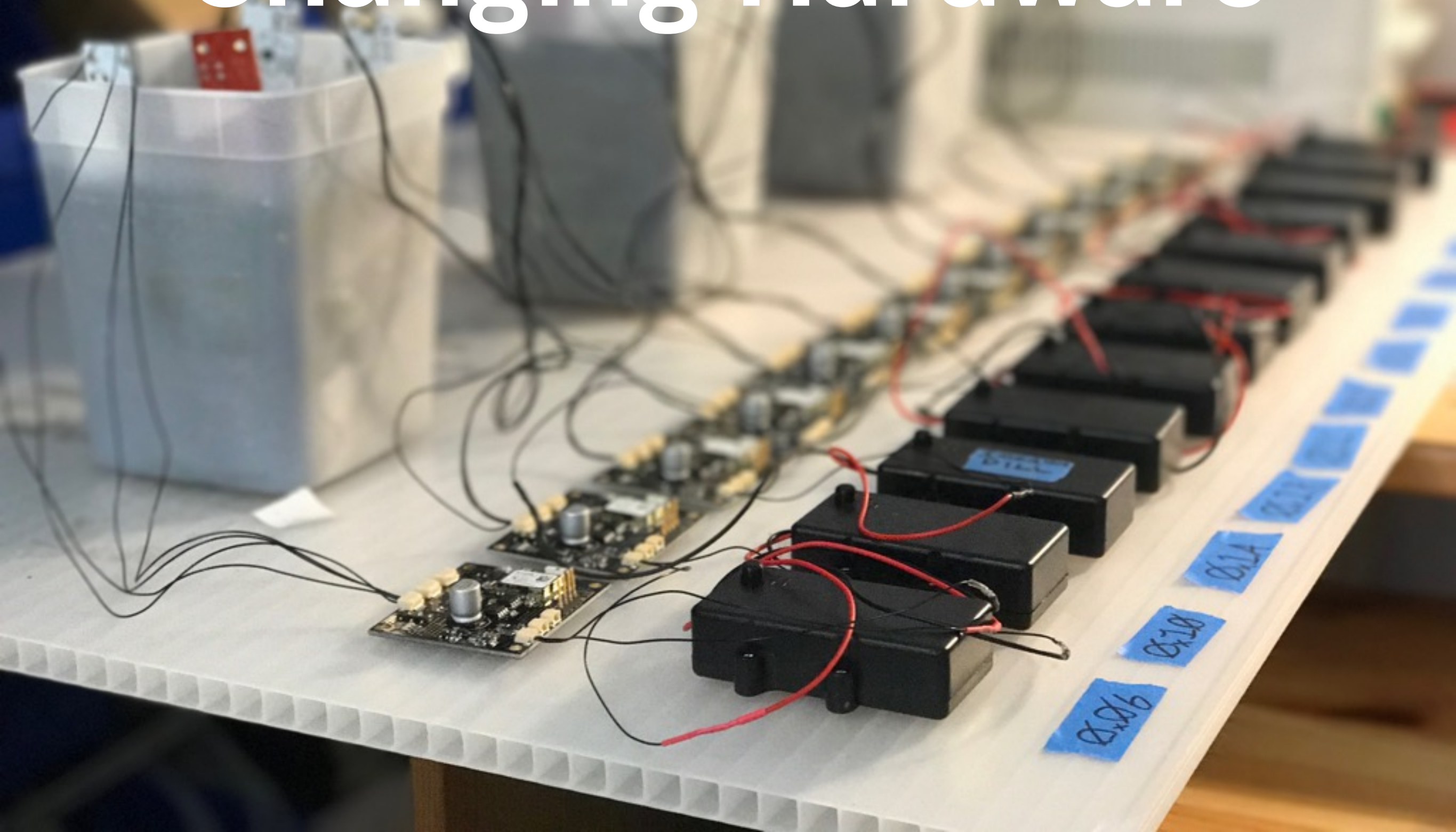


# Architecting for Changing Hardware

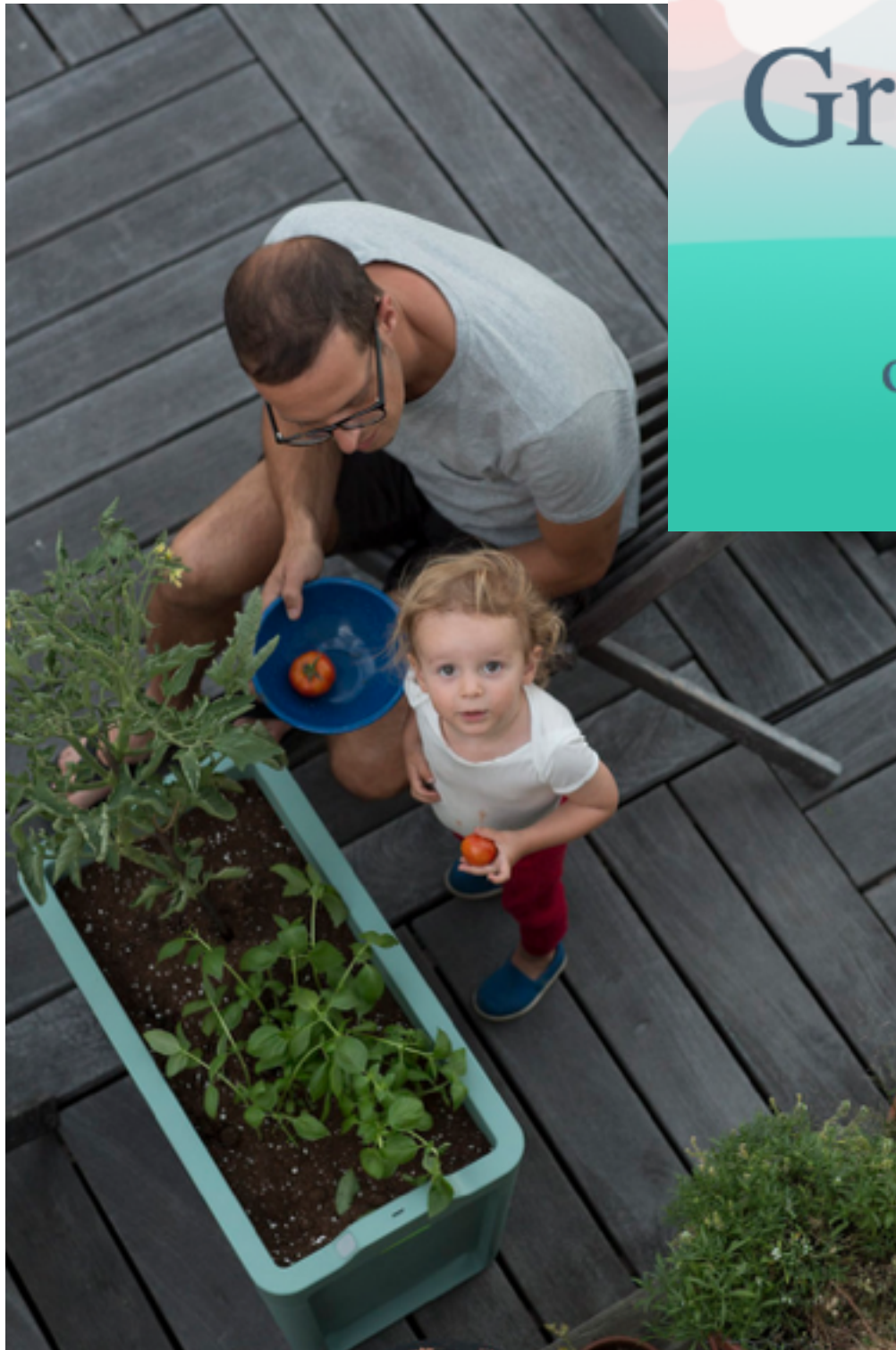






# Growing made dirt simple

We believe the benefits of growing your own food should be accessible to everyone.  
Our aim is to make that happen.

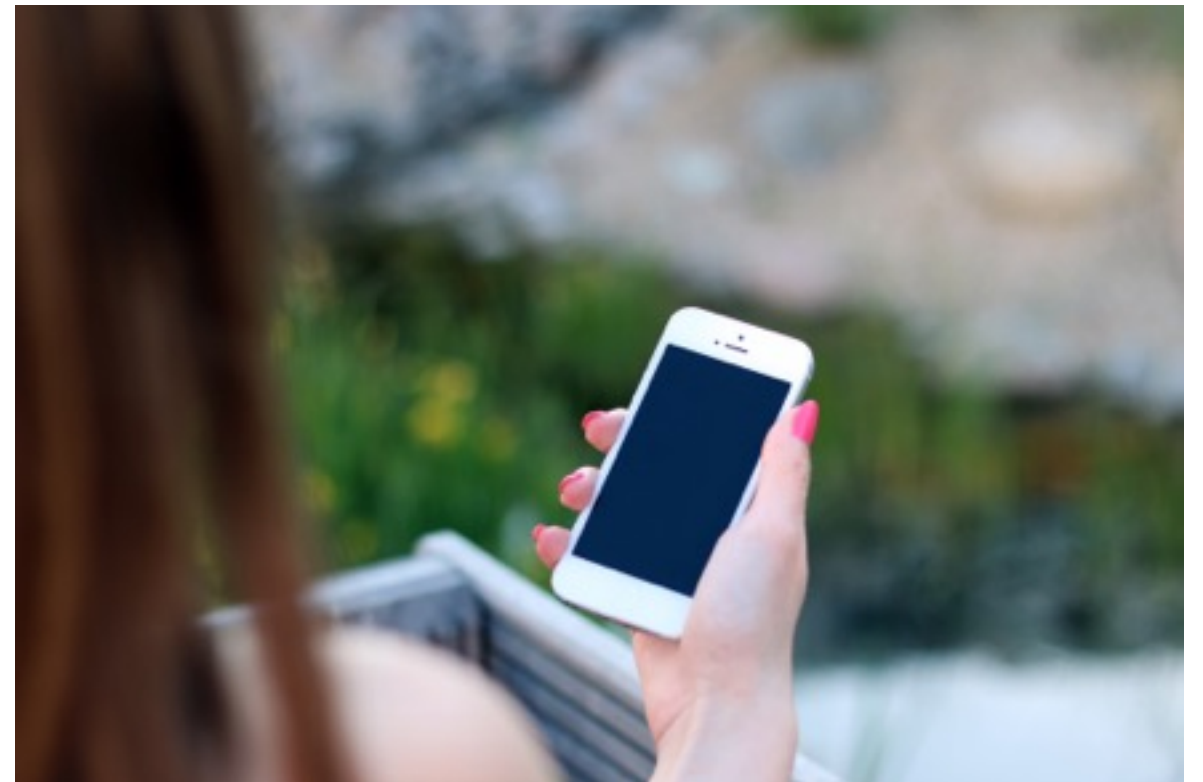


# This Talk

# Grow's Model



# Grow's Model

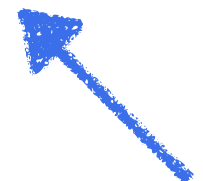








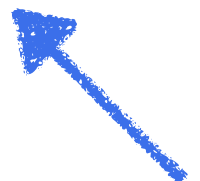
iBeacon



In your pocket



**iBeacon**

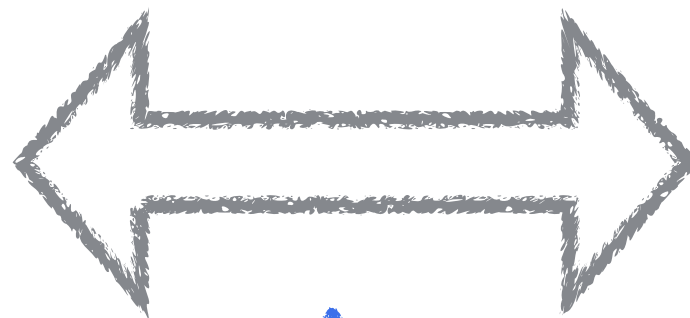


**In your pocket**

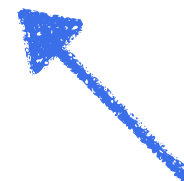




**BT Peripheral**



data  
transfer

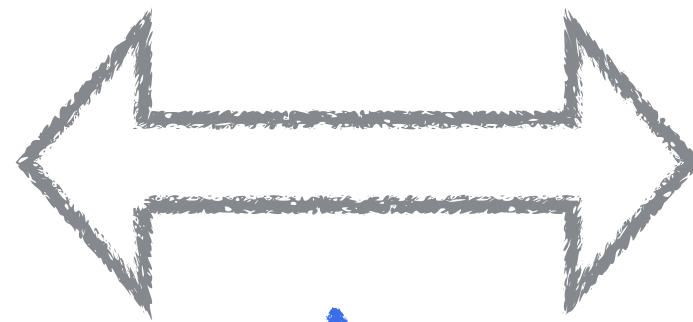


In your pocket





**BT Peripheral**



data  
transfer



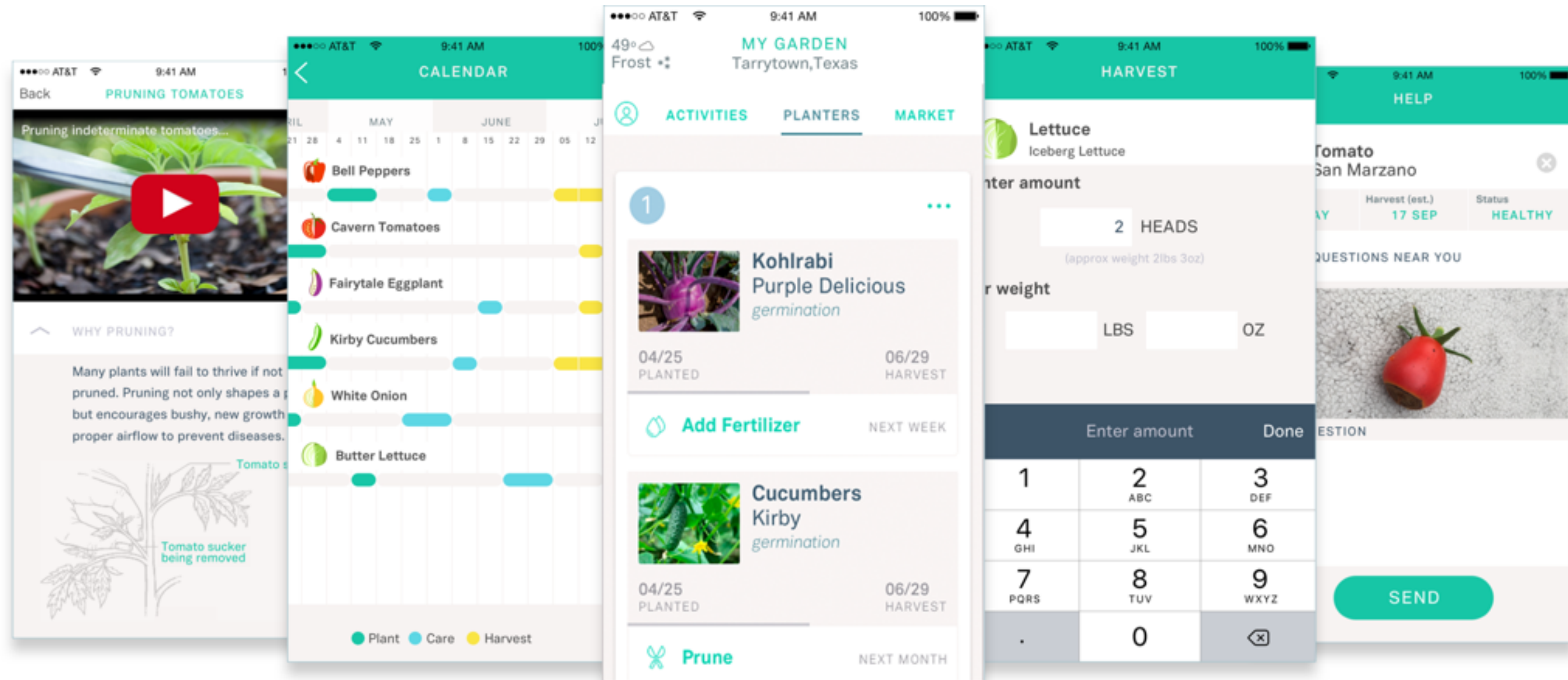
In your pocket



This is all in the  
BACKGROUND



# What they do see.



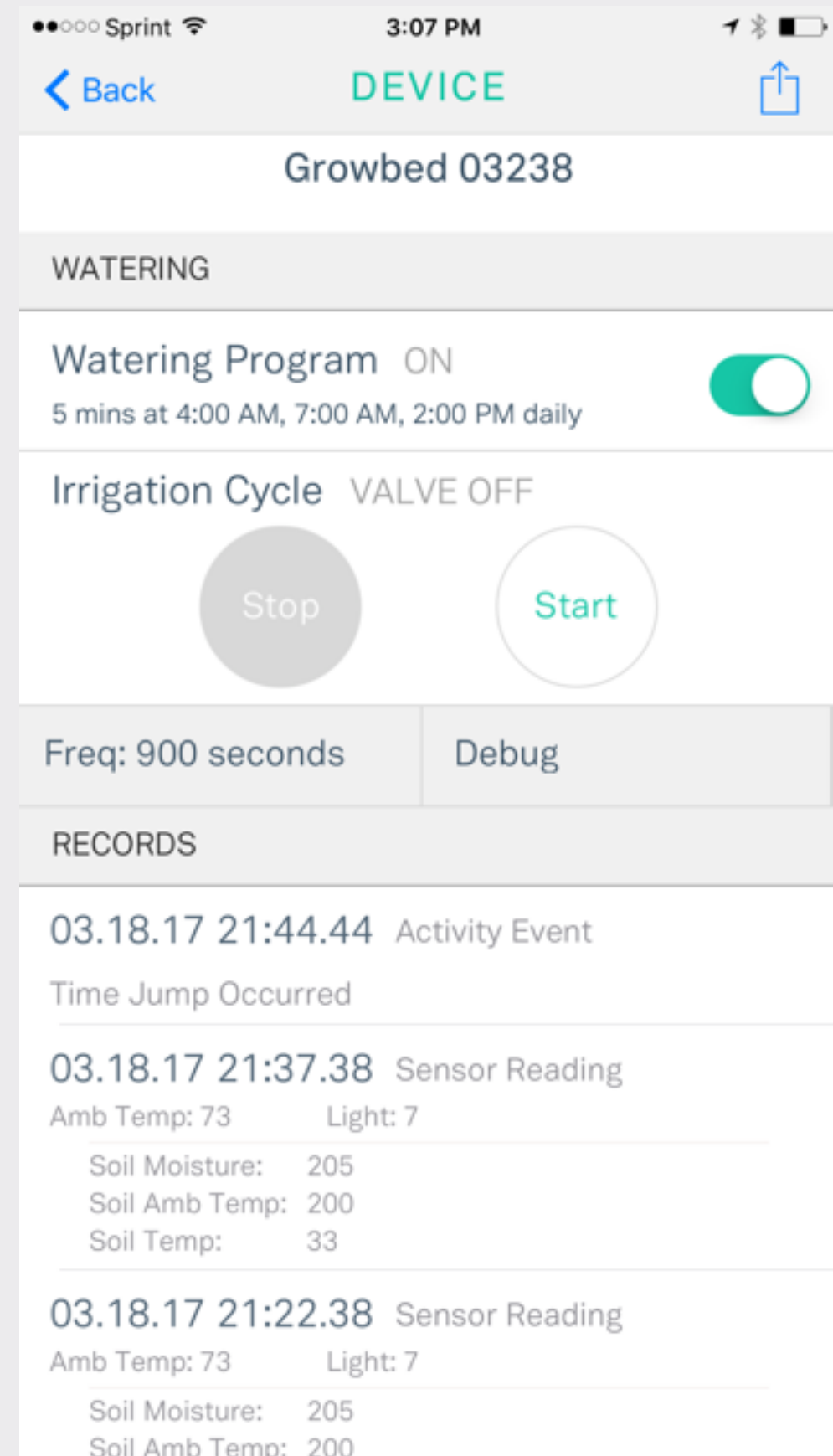
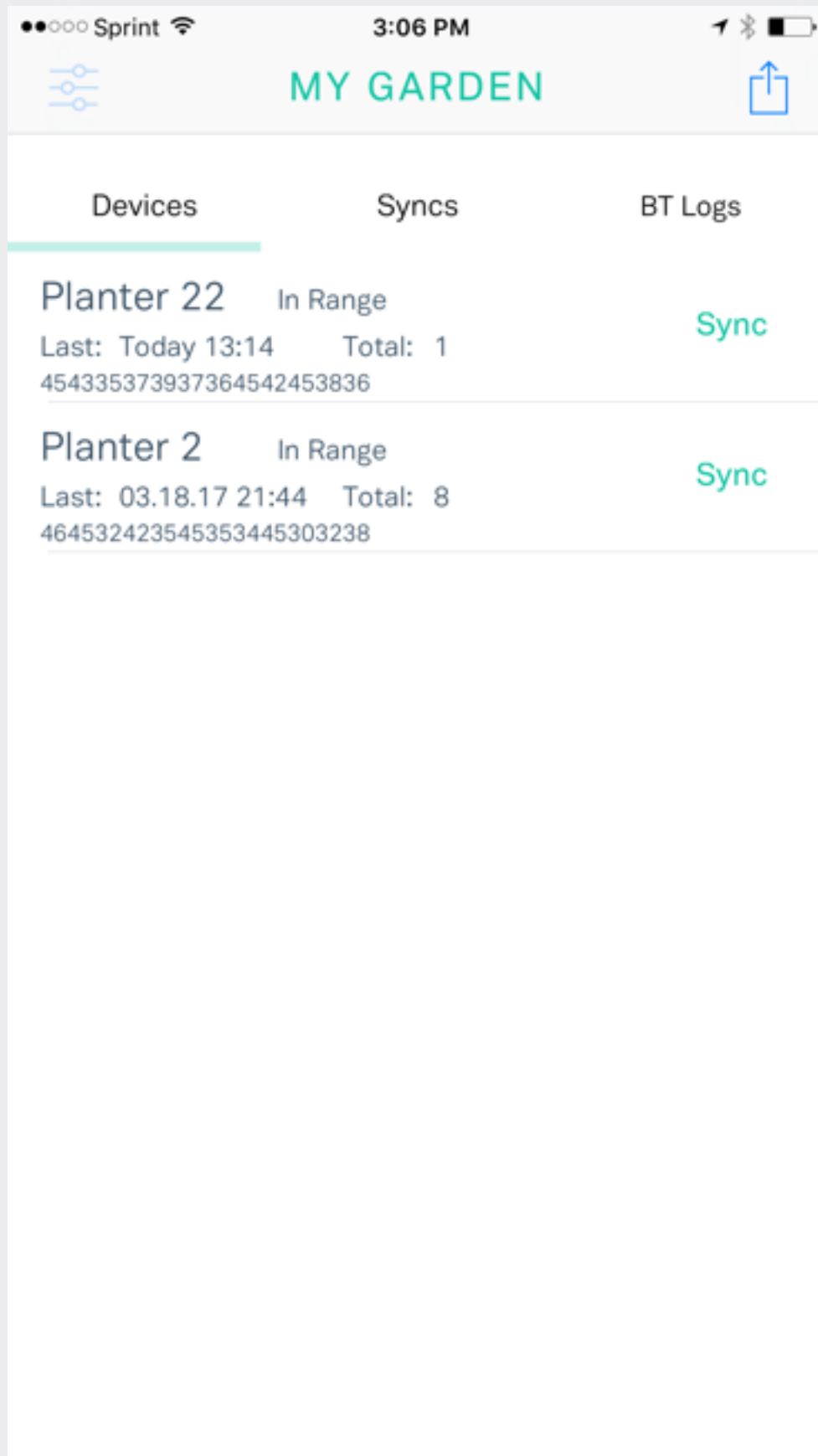
Problem?

Granular  
Control

Failure  
Visibility

# Granular Control





Sprint	3:07 PM	
Done	Sync	
●	44437 Background 03.17.17 16:31 Duration: 01.204	
Logs	Records	
03.17.17 16:20.36	Sensor Reading	
Amb Temp: 77	Light: 11	
Soil Moisture:	288	
Soil Amb Temp:	-55	
Soil Temp:	41	
03.17.17 16:05.36	Sensor Reading	
Amb Temp: 77	Light: 11	
Soil Moisture:	288	
Soil Amb Temp:	-55	
Soil Temp:	41	
03.17.17 15:50.36	Sensor Reading	
Amb Temp: 77	Light: 11	
Soil Moisture:	288	
Soil Amb Temp:	-55	
Soil Temp:	41	
03.17.17 15:35.36	Sensor Reading	
Amb Temp: 77	Light: 12	
Soil Moisture:	288	
Soil Amb Temp:	-55	
Soil Temp:	41	

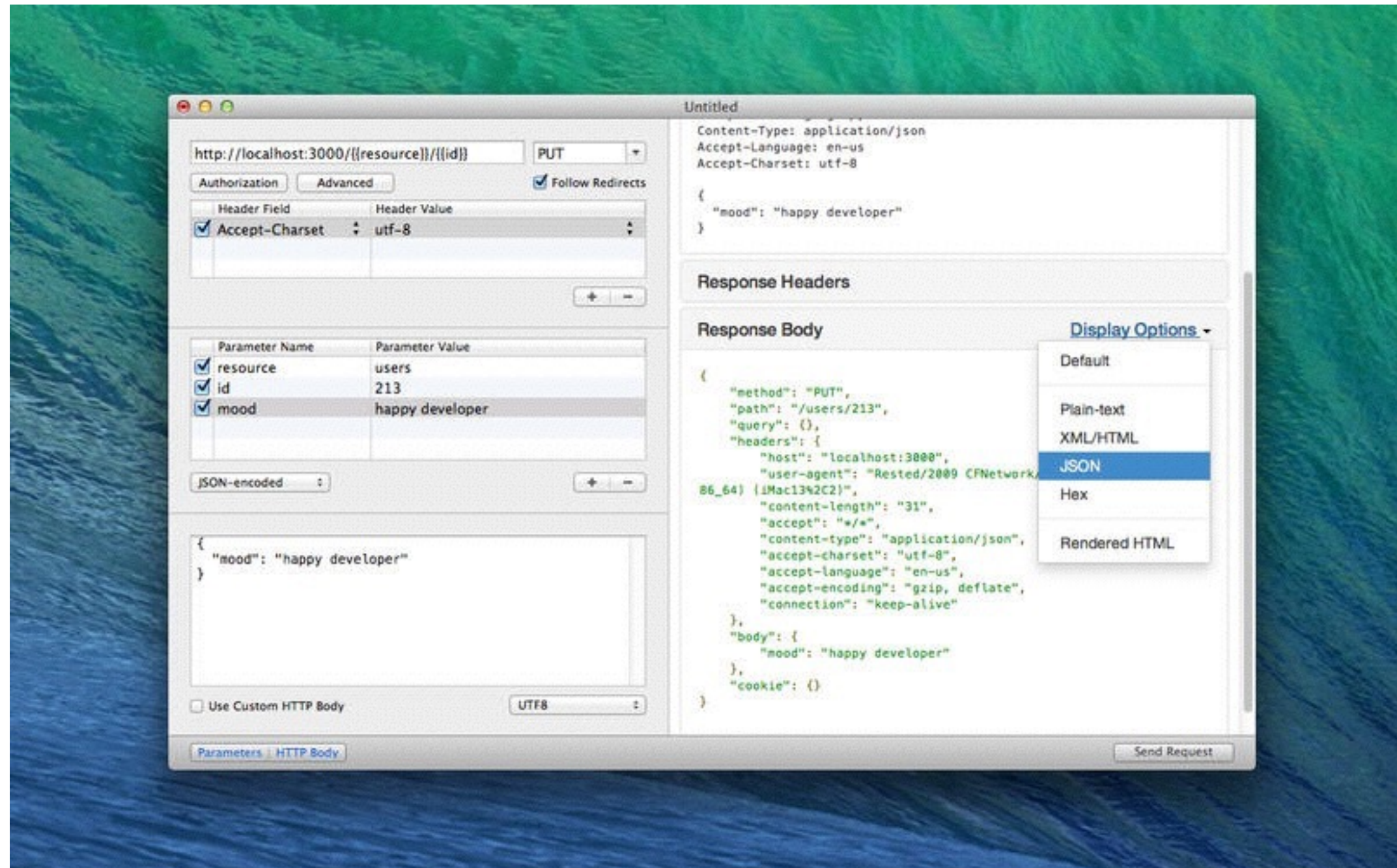
[illegible]

# Failure Visibility



# Standard Approach

# Standard Approach





# Standard Approach

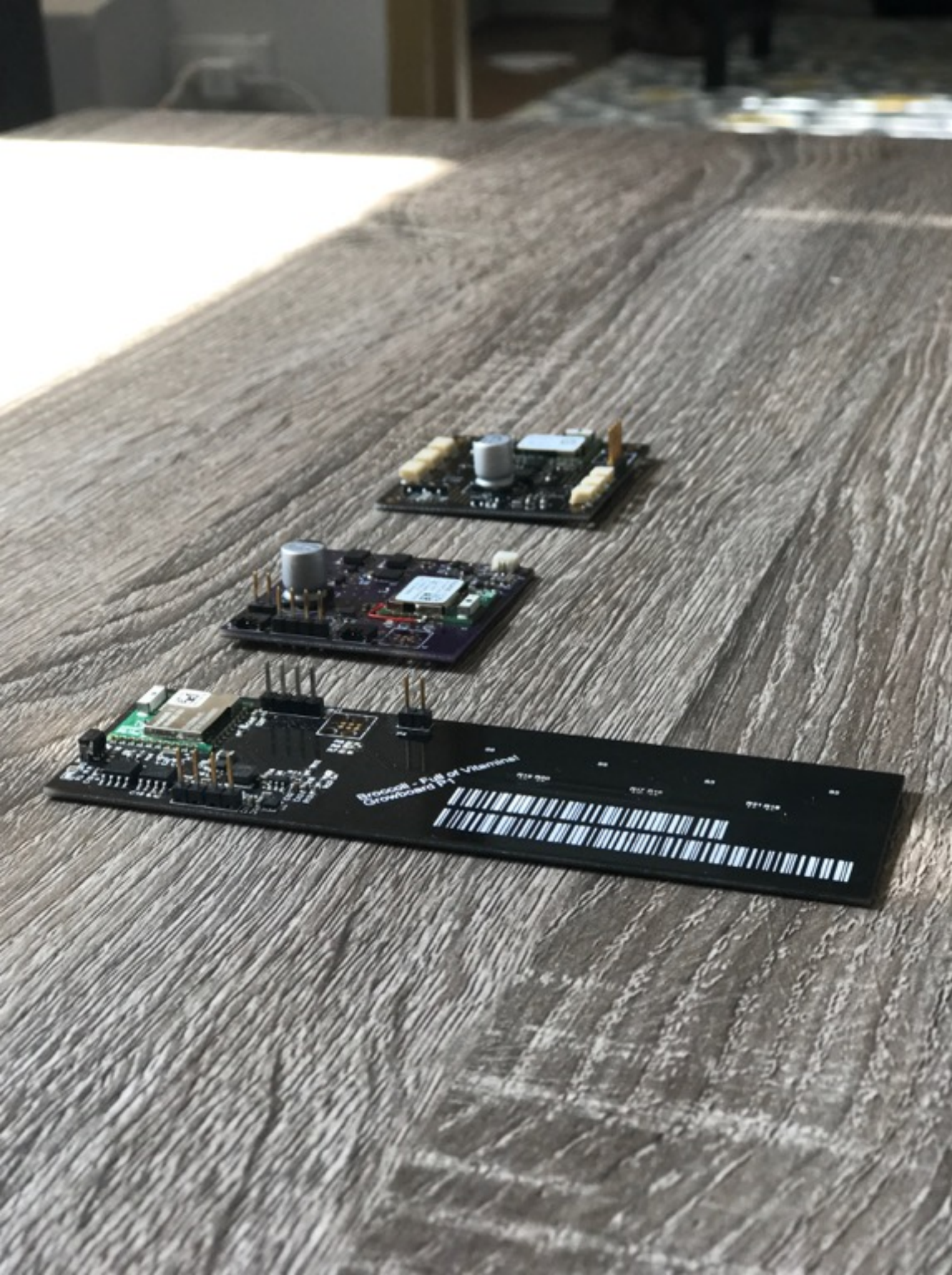
The screenshot displays the Heroku Papertrail interface for the application 'heroku-express-example'. The top navigation bar includes links for 'Heroku Add-ons', 'Resources', 'Activity', 'Access', 'Settings', and 'papertrail → Docs'. The 'papertrail' logo is on the left, and navigation tabs for 'Dashboard', 'Events', 'Alerts', 'Settings', and 'Help' are on the right. The main content area shows a list of events with timestamps, log levels, and messages. The events include deployment updates, state changes, and HTTP requests. A search bar at the bottom allows filtering by example, status, or message content.

Aug 25 13:28:32 heroku-express-example heroku/api: Deploy e178fe3 by ungmo2@gmail.com  
Aug 25 13:28:33 heroku-express-example heroku/api: Release v6 created by ungmo2@gmail.com  
Aug 25 13:28:33 heroku-express-example heroku/web.1: State changed from down to starting  
Aug 25 13:28:34 heroku-express-example heroku/web.1: Starting process with command `node index.js`  
Aug 25 13:28:37 heroku-express-example app/web.1: Node app is running on port 19846  
Aug 25 13:28:39 heroku-express-example heroku/web.1: State changed from starting to up  
Aug 25 13:28:59 heroku-express-example heroku/router: at=info method=GET path="/" host=heroku-express-example.herokuapp.com request\_id=c7952fa8-0928-4da6-b6af-219ff86b05a6 fwd="125.186.213.87" dyno=web.1 connect=1ms service=35ms status=304 bytes=147  
Aug 25 13:28:59 heroku-express-example heroku/router: at=info method=GET path="/lang-logo.png" host=heroku-express-example.herokuapp.com request\_id=f3e4c507-86a4-4637-bc5a-4148c614c4f6 fwd="125.186.213.87" dyno=web.1 connect=1ms service=6ms status=200 bytes=2567  
Aug 25 13:28:59 heroku-express-example heroku/router: at=info method=GET path="/stylesheets/main.css" host=heroku-express-example.herokuapp.com request\_id=11853a67-d327-468e-aab1-854e461da625 fwd="125.186.213.87" dyno=web.1 connect=4ms service=18ms status=200 bytes=908  
Aug 25 13:29:10 heroku-express-example heroku/router: at=info method=GET path="/sayhi" host=heroku-express-example.herokuapp.com request\_id=ded21b77-0447-40e6-83d8-8abfa14086bb fwd="125.186.213.87" dyno=web.1 connect=1ms service=3ms status=200 bytes=196  
Aug 25 13:49:29 heroku-express-example heroku/router: at=info method=GET path="/sayhi" host=heroku-express-example.herokuapp.com request\_id=30015a70-4ee5-4ca6-9137-778af93c69e6 fwd="125.186.213.87" dyno=web.1 connect=1ms service=3ms status=304 bytes=144  
Aug 25 13:50:26 heroku-express-example heroku/router: at=info method=GET path="/sayhi" host=heroku-express-example.herokuapp.com request\_id=02766327-14c1-48e0-990c-1c1a2d502b6a fwd="125.186.213.87" dyno=web.1 connect=1ms service=3ms status=304 bytes=144  
Aug 25 13:50:29 heroku-express-example heroku/router: at=info method=GET path="/sayhi" host=heroku-express-example.herokuapp.com request\_id=5f3c4cc6-795a-4b65-b76a-b5265d6f6dcc fwd="125.186.213.87" dyno=web.1 connect=2ms service=2ms status=304 bytes=144  
Aug 25 13:50:33 heroku-express-example heroku/router: at=info method=GET path="/sayhi" host=heroku-express-example.herokuapp.com request\_id=2aa824aa-a326-423a-a17f-1917fb24d58c fwd="125.186.213.87" dyno=web.1 connect=1ms service=5ms status=304 bytes=144  
Aug 25 13:50:42 heroku-express-example heroku/api: Deploy f2791b1 by ungmo2@gmail.com  
Aug 25 13:50:42 heroku-express-example heroku/slug-compiler: Slug compilation started  
Aug 25 13:50:43 heroku-express-example heroku/api: Release v7 created by ungmo2@gmail.com  
Aug 25 13:50:43 heroku-express-example heroku/slug-compiler: Slug compilation finished  
Aug 25 13:50:43 heroku-express-example heroku/web.1: Restarting  
Aug 25 13:50:43 heroku-express-example heroku/web.1: State changed from up to starting  
Aug 25 13:50:44 heroku-express-example heroku/web.1: Starting process with command `node index.js`  
Aug 25 13:50:46 heroku-express-example heroku/web.1: Stopping all processes with SIGTERM  
Aug 25 13:50:46 heroku-express-example app/web.1: Node app is running on port 25969  
Aug 25 13:50:46 heroku-express-example heroku/web.1: Process exited with status 143  
Aug 25 13:50:48 heroku-express-example heroku/web.1: State changed from starting to up

Example: H12 OR status=5 OR "Starting process" -png Search heroku-express-example PAUSE



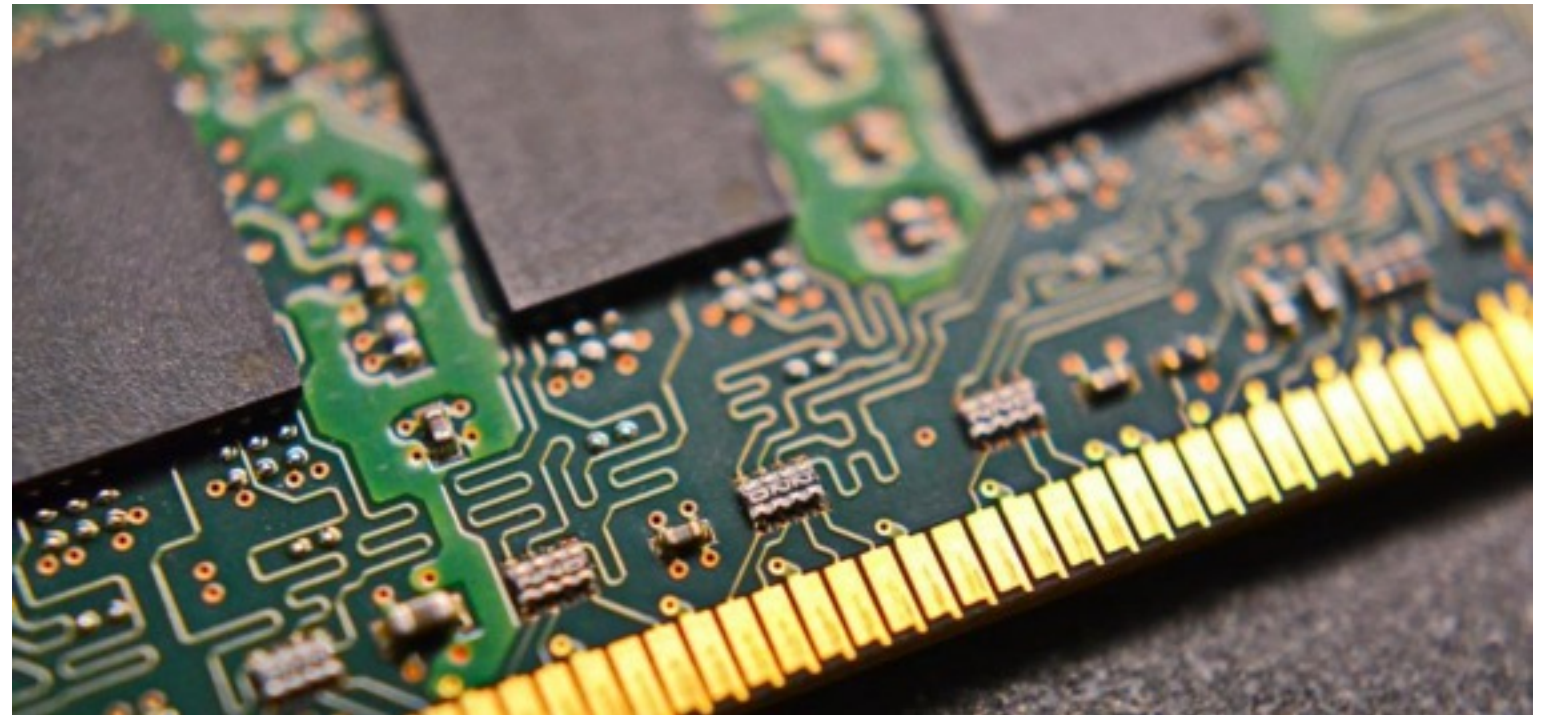
What's Different  
w/ Hardware



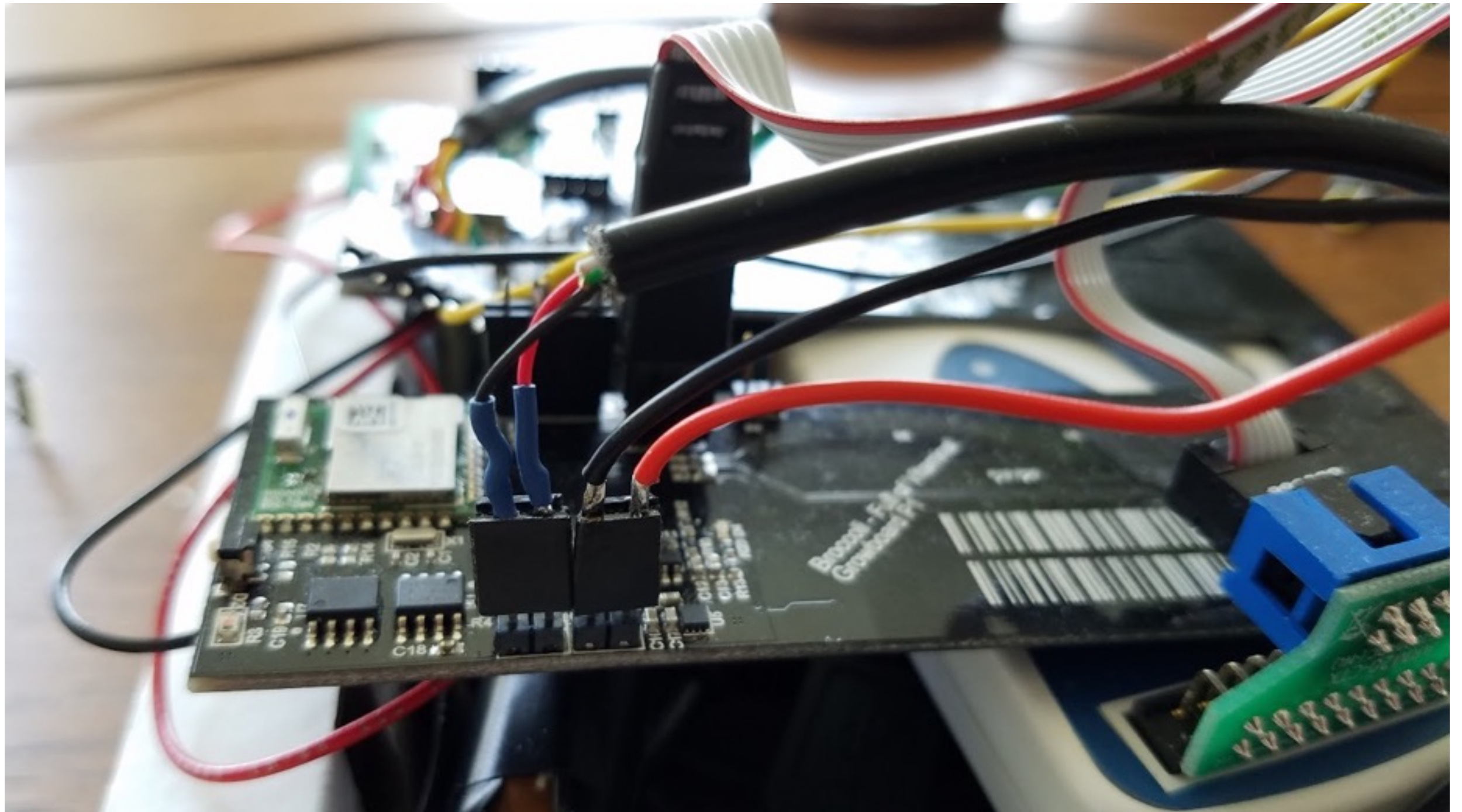
# Isolated Device



# Logging Limitations



# Actual Firmware Dev Approach





In steps the App!

# Architecting For Visibility

# Example Operations

# Example Operations

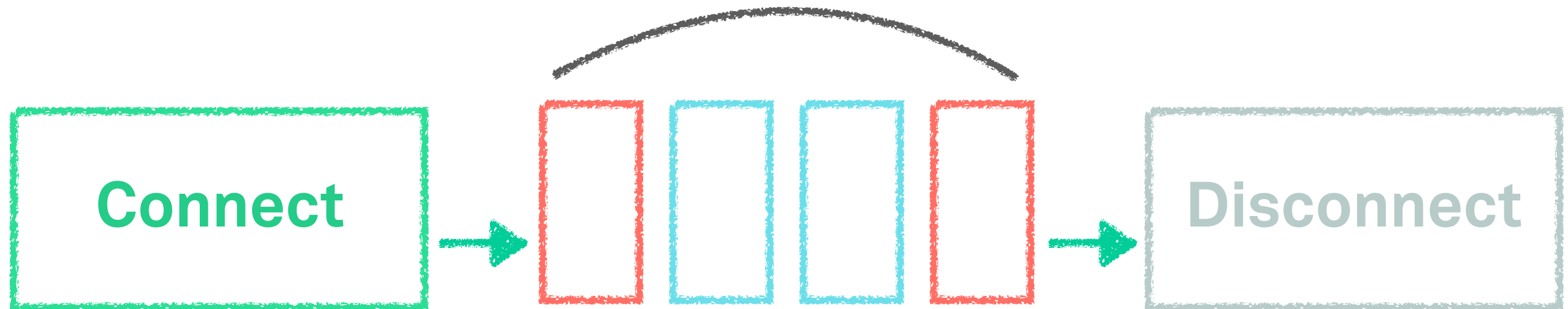
Setup Bed

Send New  
Water Program

Retrieve Latest  
Data

# Typical Exchange

Series of  
Commands/Operations





# Setup Device



```
enum OperationEndingStatus: Int {  
    case successful = 0,  
        failedDisconnected,  
        failedTimedOut,  
        failedError,  
        cancelled,  
        deviceNotFound,  
        networkError  
}
```

# Retrieve Latest Data

