

Senior Design: Power Supply Module

Hyperloop II: Dashboard

The following slides include screenshots of the web-based dashboard I created to monitor and control our pod for the second hyperloop competition (Summer 2017).

The embedded system is one [STM32 Nucleo 144 F767ZI](#) microcontroller development board. We wrote all of the firmware [from-scratch](#) and used [LwIP](#) to implement the network stack.

The “terminal” shown in the following slides is “redirected stdout” from the microcontroller, not an SSH session or userspace Linux program.

Bootstrapping the microcontroller’s serial terminal to a web-based UI is the key feature of this UI.

Hyperloop II: Dashboard

Console left (showing boot post and help command), data table right

Badgerloop Dashboard

localhost:8080/#/home

STM32 Nucleo 144 Serial Console

```
DBG: ON (32768 Hz), bypass on
PLL: ON (source: HSE)
PLLSAI: OFF
PLLIS: OFF
LSI: OFF
LSE: OFF (32768 Hz), bypass off

Frequencies:
SYSCLK: 160000 kHz (source: PLL)
HCLK: 160000 kHz
APB1: 40000 kHz
APB2: 80000 kHz

Use 'help' for a list of commands.
-----
=> assert_fault: primary battery voltage 00M

help
help - Display a command's help message.
memmap - Display where different physical hardware peripherals
pin - Perform live manipulation of GPIO pins.
adc - Perform ADC conversions on available pins.
reset - Software reset.
float - Float point calculation using FPU.
eth - Debug Ethernet capabilities.
exti - Prints current and previous time stamp of the External Interrupt. Only on
interrupt per pin number.
i2c - Perform live interaction with the I2C devices default list all devices
badgerloop - Debug Badgerloop Networking etc.
=>
unknown command: '' - try 'help'
=>
```

Command Text

CLEAR

Badgerloop Dashboard - Mozilla Firefox

Search

Microcontroller Data

| | | |
|-----------------------|-----------|------|
| State: | IDLE | 6000 |
| Stopping Distance: | 0 cm | 6000 |
| Strip Count: | 0 | 6000 |
| Position: | 0 cm | 6000 |
| Acceleration: | 0 cm/s^2 | 6000 |
| Velocity: | 0 m/s | 6000 |
| Percent Charge: | 100 % | 6000 |
| Charge Remaining: | 100 m | 6000 |
| Current: | 6 A | 6000 |
| Battery Temperature: | 25 C | 6000 |
| Voltage: | 14 V | 6000 |
| Brake Line Secondary: | 120 PSI | 6000 |
| Brake Line Primary: | 120 PSI | 6000 |
| Brake Pads Primary: | 0 PSI | WARN |
| Prop. Sirocco: | 3300 PSI | 6000 |
| Prop. LTE: | 3300 PSI | 6000 |
| Ambient Pressure: | 14.75 PSI | 6000 |
| Ambient Temperature: | 25 C | 6000 |
| Limit Switches: | 0 | 6000 |

Status change! undefined -> IDLE
Switches change! undefined -> 0

CLEAR

FULL

1/0

Hyperloop II: Dashboard

Console left (showing post and help command), manual IO menu right

STM32 Nucleo 144 Serial Console

```
HSE: ON (3000000 Hz), bypass on
PLL: ON (source: HSE)
PLLSAI: OFF
PLLIS: OFF
LSI: OFF
LSE: OFF (32768 Hz), bypass off

Frequencies:
HCLK: 160000 kHz (source: PLL)
HCLKI: 160000 kHz
APB1: 40000 kHz
APB2: 80000 kHz

Use 'help' for a list of commands.
-----
=> assert_fault: primary battery voltage 00M

help
help - Display a command's help message.
memmap - Display where different physical hardware peripherals
boot - Run currently selected main routine.
pin - Perform live manipulation of GPIO pins.
ar - Perform ADC conversions on available pins.
reset - Software reset.
float - Float point calculation using FPU.
eth - Debug Ethernet capabilities.
exti - Prints current and previous time stamp of the External Interrupt. Only on
interrupt per pin number.
i2c - Perform live interaction with the I2C devices default list all devices
badgerloop - Debug Badgerloop Networking etc.
=>
unknown command: '' - try 'help'
=>
```

Microcontroller Data

PLIM1: depressed
PLIM2: depressed
BLIM1: depressed
BLIM2: depressed
DLIM: depressed

State Change Overrides

FAULT IDLE READY PUSHING COASTING BRAKING

Actuation Overrides

PRIM. BRAKE ON PRIM. BRAKE OFF
SEC. BRAKE ON SEC. BRAKE OFF
PRIM. BRAKE VENT ON PRIM. BRAKE VENT OFF
VENT PROP. ON VENT PROP. OFF ACTUATE PROP. ON ACTUATE PROP. OFF

Command Text

Hyperloop II: Dashboard

memmap output and badgerloop sub-commands

```
APB1 UART5 40005000 1023 bytes
APB1 UART4 40004c00 1023 bytes
APB1 USART3 40004800 1023 bytes
APB1 USART2 40004400 1023 bytes
APB1 SPDIFRX 40004000 1023 bytes
APB1 SPI3/I2S3 40003c00 1023 bytes
APB1 SPI2/I2S2 40003800 1023 bytes
APB1 CAN3 40003400 1023 bytes
APB1 IWDG 40003000 1023 bytes
APB1 WWDG 40002c00 1023 bytes
APB1 RTC & BKP rgstrs 40002800 1023 bytes
APB1 LPTIM1 40002400 1023 bytes
APB1 TIM14 40002000 1023 bytes
APB1 TIM13 40001c00 1023 bytes
APB1 TIM12 40001800 1023 bytes
APB1 TIM7 40001400 1023 bytes
APB1 TIM6 40001000 1023 bytes
APB1 TIM5 40000c00 1023 bytes
APB1 TIM4 40000800 1023 bytes
APB1 TIM3 40000400 1023 bytes
APB1 TIM2 40000000 1023 bytes

=> help badgerloop
Debug Badgerloop Networking etc.
Usage: badgerloop
DBTO - Don't brake timeout
MBTO - Must brake timeout
BCT - Braking count threshold
ACCEL - Accelerometer impulse cap
TEP - Target end position
CMPS - Centimeters per strip
override [ on | off ] - stop DAQ and override sensor data
fault - print current fault message
=>
```

Hyperloop II: Dashboard

ar (analog read) command output, raw 10-bit ADC

```
baudgerloop - Debug Baudgerloop Networking etc.
```

```
=> ar
```

```
IBATT: 279
```

```
Analog2: 279
```

```
Analog3: 280
```

```
PRP2: 274
```

```
VBATT: 284
```

```
PRP1: 282
```

```
BRP2: 285
```

```
BRP1: 287
```

```
BPR3: 282
```

```
ACCEL: 284
```

```
TH1: 293
```

```
TH2: 280
```

```
Analog13: 286
```

```
TH3: 271
```

```
TH4: 274
```

```
=> ar
```

```
IBATT: 278
```

```
Analog2: 278
```

```
Analog3: 279
```

```
PRP2: 274
```

```
VBATT: 284
```

```
PRP1: 282
```

```
BRP2: 286
```

```
BRP1: 287
```

```
BPR3: 282
```

```
ACCEL: 284
```

```
TH1: 294
```

```
TH2: 281
```

```
Analog13: 284
```

```
TH3: 270
```

```
TH4: 272
```

Hyperloop II: Dashboard

Development on the Dashboard on the road to the competition from Wisconsin

