CPE301 – SPRING 2019

MIDTERM 1

Student Name: Geovanni Portillo
Student #: 8000603824
Student Email: portig1@gmail.com
Primary Github address: https://github.com/portig1/submissions_E
Directory: portig1/submissions_E/tree/master/Midterms/Midterm_1

Submit the following for all Labs:

1. In the document, for each task submit the modified or included code (only) with highlights and justifications of the modifications. Also, include the comments.
2. Use the previously create a Github repository with a random name (no CPE/301, Lastname, Firstname). Place all labs under the root folder ESD301/Midterm, sub-folder named LABXX, with one document and one video link file for each lab, place modified asm/c files named as LabXX-TYY.asm/c.
3. If multiple asm/c files or other libraries are used, create a folder LabXX-TYY and place these files inside the folder.
4. The folder should have a) Word document (see template), b) source code file(s) and other include files, c) text file with youtube video links (see template).

1. COMPONENTS LIST AND CONNECTION BLOCK DIAGRAM w/ PINS

Atmel Studio 7
ATmega328PB Xplained mini

Figure 1-1. ATmega328P Xplained Mini Headers and Connectors

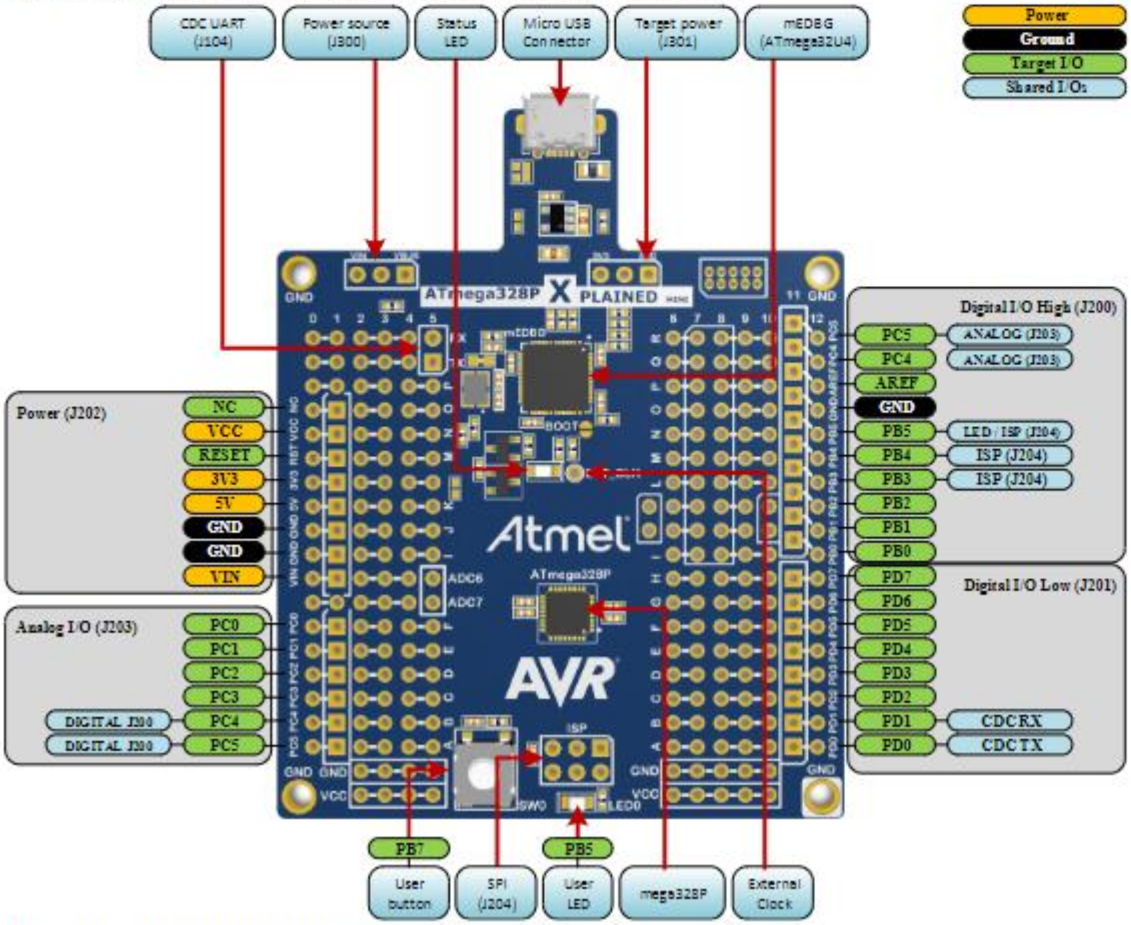
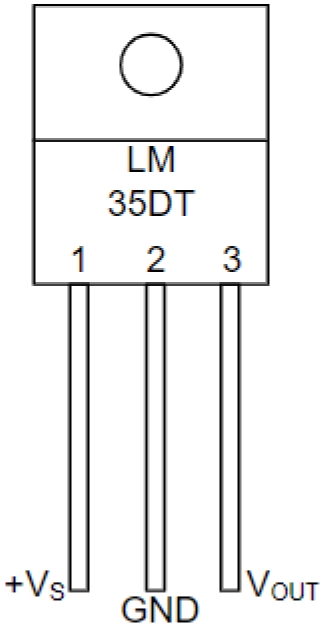
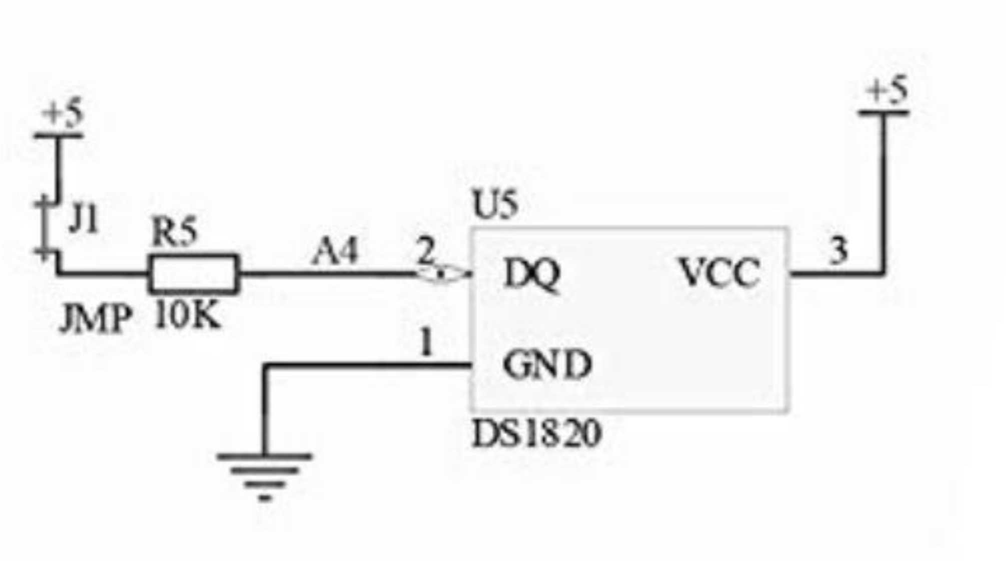


Table 1-1. Default Configurations

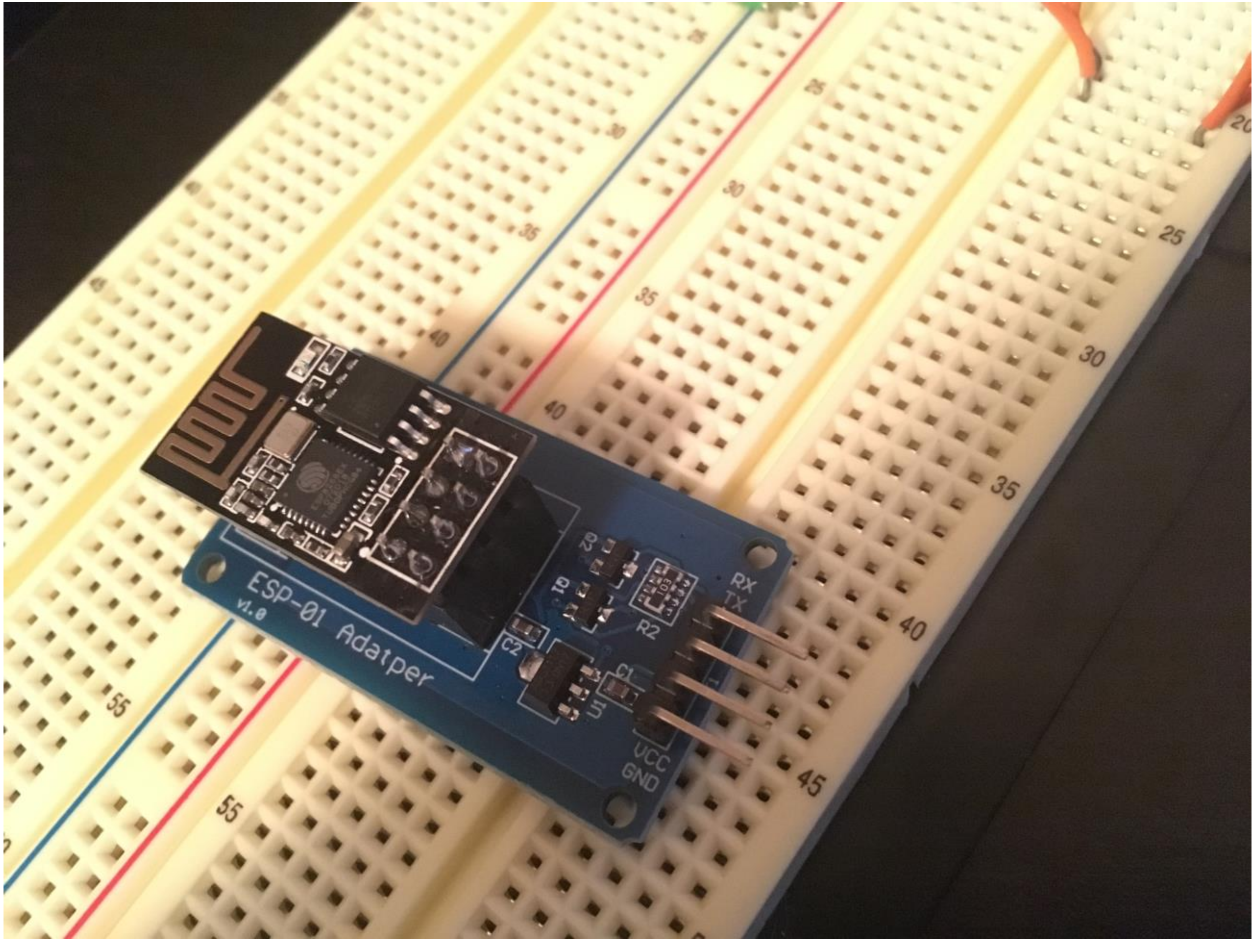


LM35 Schematic



Arduino Shield U5 Schematic

ESP-01 to USB Programmer/Adapter



ESP-01 Adapter with ESP8266 plugged in

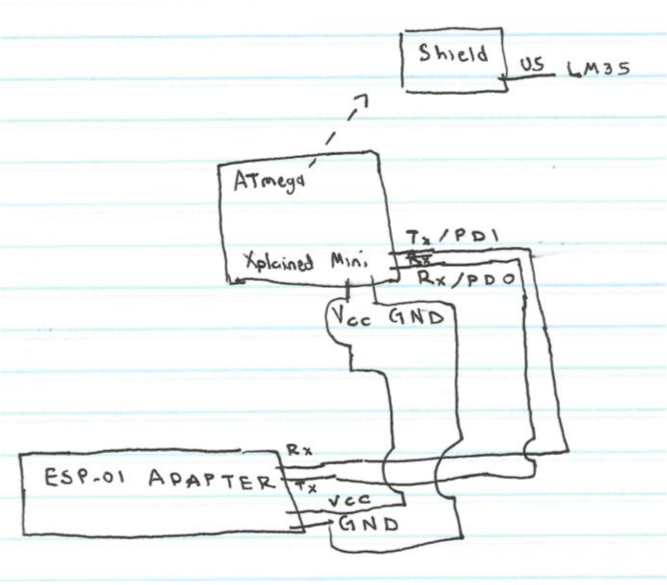
2. DEVELOPED CODE OF TASK 1/2/5/6

```
/*
	Currently I've been able to send 12 temperature values to the ThingSpeak channel 
through the board setup. When I used a USB adapter for the ESP-01 module to
	and ran the command sequence to send test values I was only able to send 4 values 
and I was repeatedly sending commands till it happened to work. Screenshots of 
	ESPlorer tests are included in the documentation document
*/
```

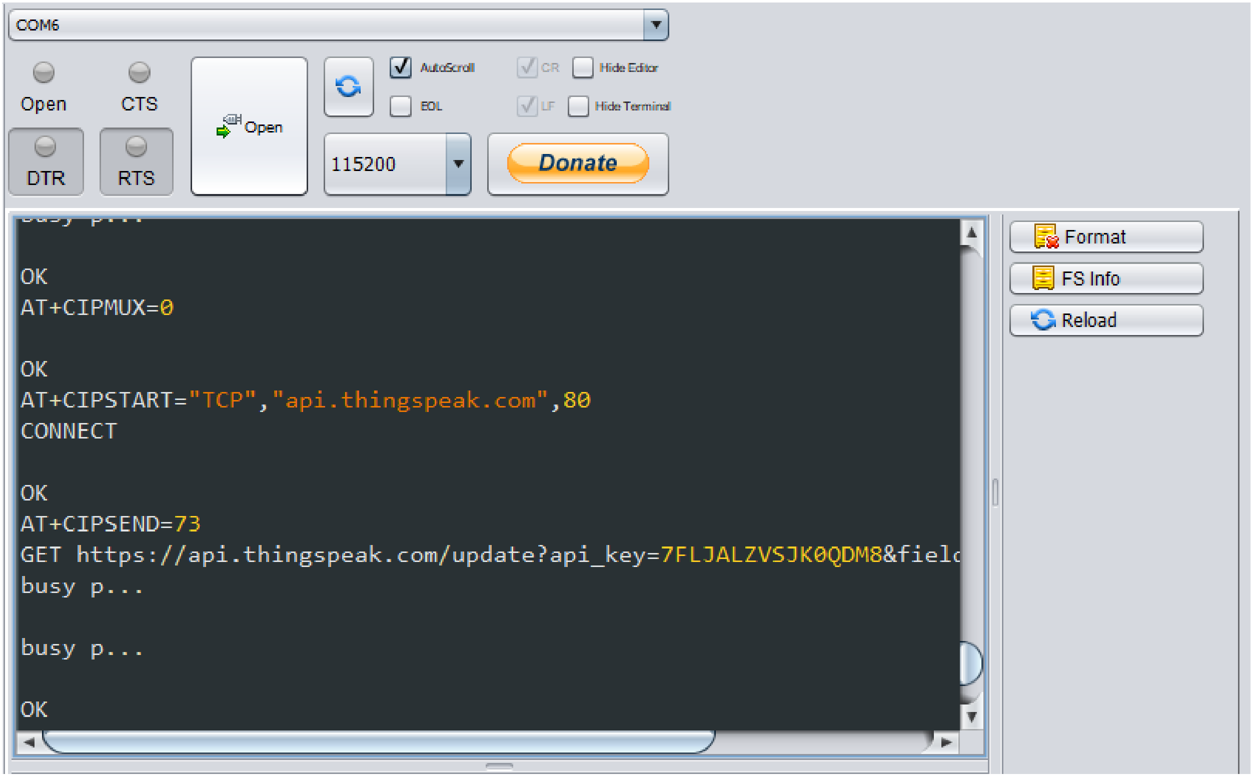
```c
#define F_CPU 16000000UL
#define BAUD_RATE 115200 //BAUD RATE for ESP01 Module
#define BAUD_PRESCALLER (((F_CPU / (BAUD_RATE * 16UL))) - 1) //Gets ignored as the value for UBRR0 at 115200 BAUD RATE is floating point and the error rate was too high

#include <avr/io.h>
#include <avr/interrupt.h>
#include <stdio.h>
#include <util/delay.h>

void usart_init ();
void USART_send(unsigned char data);
void USART_putstring(char* StringPtr);


int main (void)
{
	usart_init ();
	
	sei();
	TIMSK1 = (1 << OCIE1A);
	OCR1A = 62499; //Using TCNT = clk*delay/prescaler - 1 to find OCR1A given clk = 16MHz, OCR1A was calculated to 62,499
	TCCR1A = 0; // COM1A/B Normal Operation, OC1A/B Disconnected
	TCCR1B = (1 << WGM12) | (1 << CS12); //WGM CTC Mode, Prescaler = 256
	
	/** Setup and enable ADC **/
	ADMUX = (0<<REFS1)|    // Reference Selection Bits
	(1<<REFS0)|    // AVcc - external cap at AREF
	(0<<ADLAR)|    // ADC Left Adjust Result
	(1<<MUX2)|     // Analog Channel Selection Bits
	(0<<MUX1)|     // ADC4 (PC4 PIN27)
	(0<<MUX0);
	ADCSRA = (1<<ADEN)|    // ADC Enable
	(0<<ADSC)|     // ADC Start Conversion
	(0<<ADATE)|    // ADC Auto Trigger Enable
	(0<<ADIF)|     // ADC Interrupt Flag
	(0<<ADIE)|     // ADC Interrupt Enable
	(1<<ADPS2)|    // ADC Prescaler Select Bits
	(0<<ADPS1)|
	(1<<ADPS0);
	
	while (1)
	{
		
	}
	return 0;
}

ISR(TIMER1_COMPA_vect)
{
	ADCSRA|=(1<<ADSC);   //start conversion
	while((ADCSRA&(1<<ADIF))==0);//wait for conversion to finish
	
	ADCSRA |= (1<<ADIF);
	char thingSpeakUpdate[100];
	int tempC = ADCL;
	tempC = tempC | (ADCH<<8);
```

```
       tempC = (tempC/1024.0) * 5000/10;  //finish properly formatting tempC value

       char setMUX[] = "AT+CIPMUX=0\r\n"; //Repeating the steps ESPlorer used
       USART_putstring(setMUX);
       _delay_ms(1000);

       char thingSpeakStart[] = "AT+CIPSTART=\"TCP\",\"api.thingspeak.com\",80\r\n" ;
       USART_putstring(thingSpeakStart);
       _delay_ms(1000); //add in delay to allow for proper interactions

       char thingSpeakSend[] = "AT+CIPSEND=80\r\n"; //saying we'll send more data than we
actually will
       USART_putstring(thingSpeakSend);
       _delay_ms(1000);

       snprintf(thingSpeakUpdate, sizeof(thingSpeakUpdate), "GET
https://api.thingspeak.com/update?api_key=7FLJALZVSJK0QDM8&field1=%d\r\n", tempC);
       USART_putstring(thingSpeakUpdate);
       _delay_ms(1000);

       char thingSpeakClose[] = "AT+CIPCLOSE\r\n";
       USART_putstring(thingSpeakClose);
       _delay_ms(1000);
}

void usart_init (void)
{
       //UBRR0H = (uint8_t)(BAUD_PRESCALLER >> 8);
       //UBRR0L = (uint8_t)(BAUD_PRESCALLER);
       UBRR0 = 8;    //Manually setting as the formula give a float value that has too
much error.
       //UCSR0A = (1 << U2X0);
       UCSR0B = (1 << RXEN0) | (1 << TXEN0);
       UCSR0C = (1<< UCSZ01)|(1<<UCSZ00);
}


void USART_send( unsigned char data) {

       while (!(UCSR0A & (1 << UDRE0))); //wait until UDR0 is empty
       UDR0 = data;                              //transmit ch

}

void USART_putstring(char* StringPtr) {

       while (*StringPtr != 0x00) {
              USART_send(*StringPtr);
              StringPtr++;
       }

}
```

3. SCHEMATICS

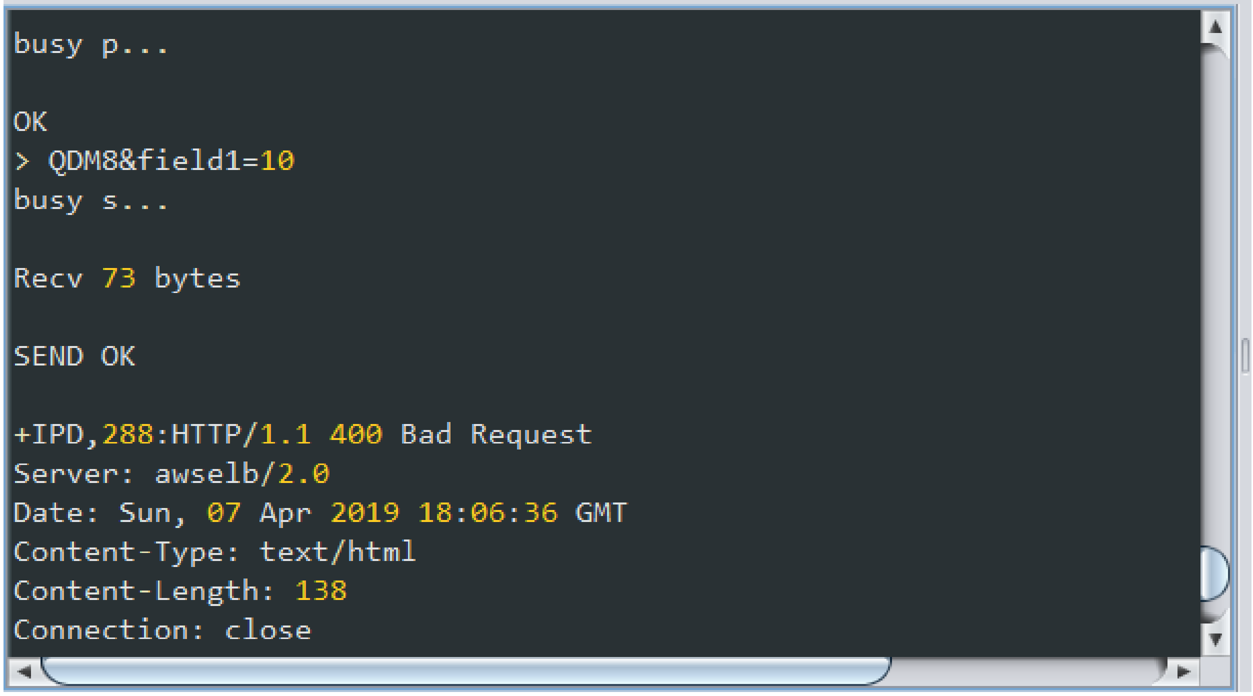


4. SCREENSHOTS OF EACH TASK OUTPUT (ATMEL STUDIO OUTPUT)



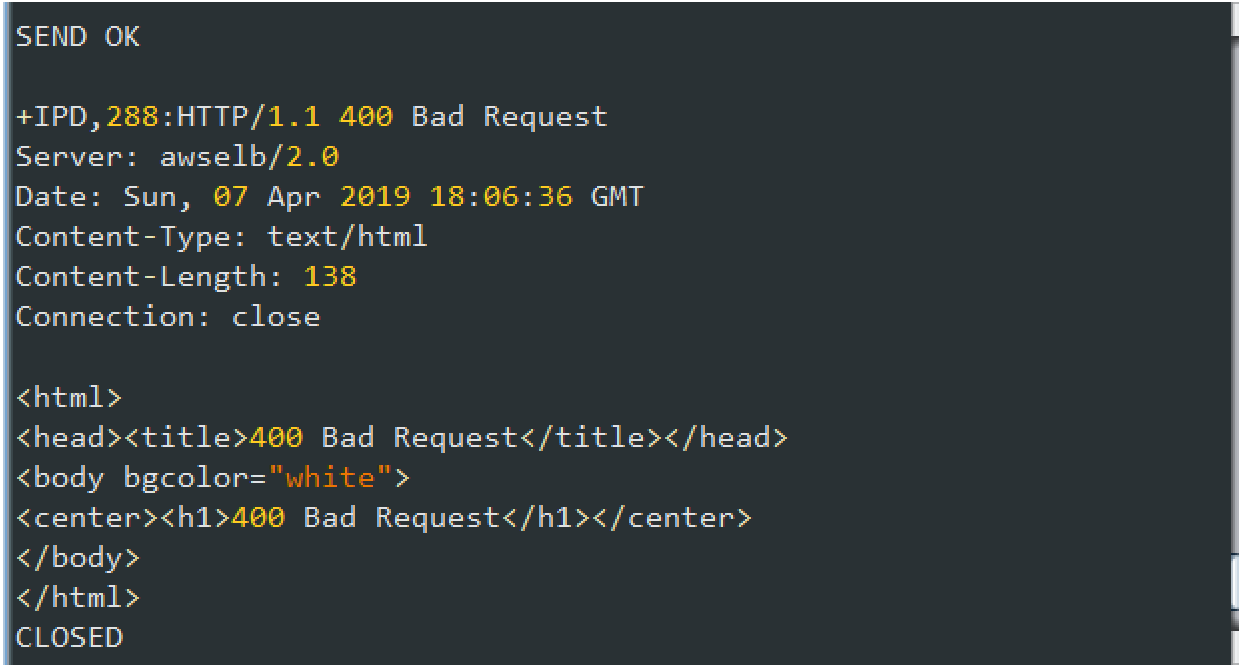
```
busy p...

OK
AT+CIPMUX=0

OK
AT+CIPSTART="TCP","api.thingspeak.com",80
CONNECT

OK
AT+CIPSEND=73
GET https://api.thingspeak.com/update?api_key=7FLJALZVSJK0QDM8&fiel
busy p...

busy p...

OK
```

Output from ESPlorer tests, command sequence starts with “AT+CIPMUX”. I would often get a “busy p…” response when trying to use the send and GET command



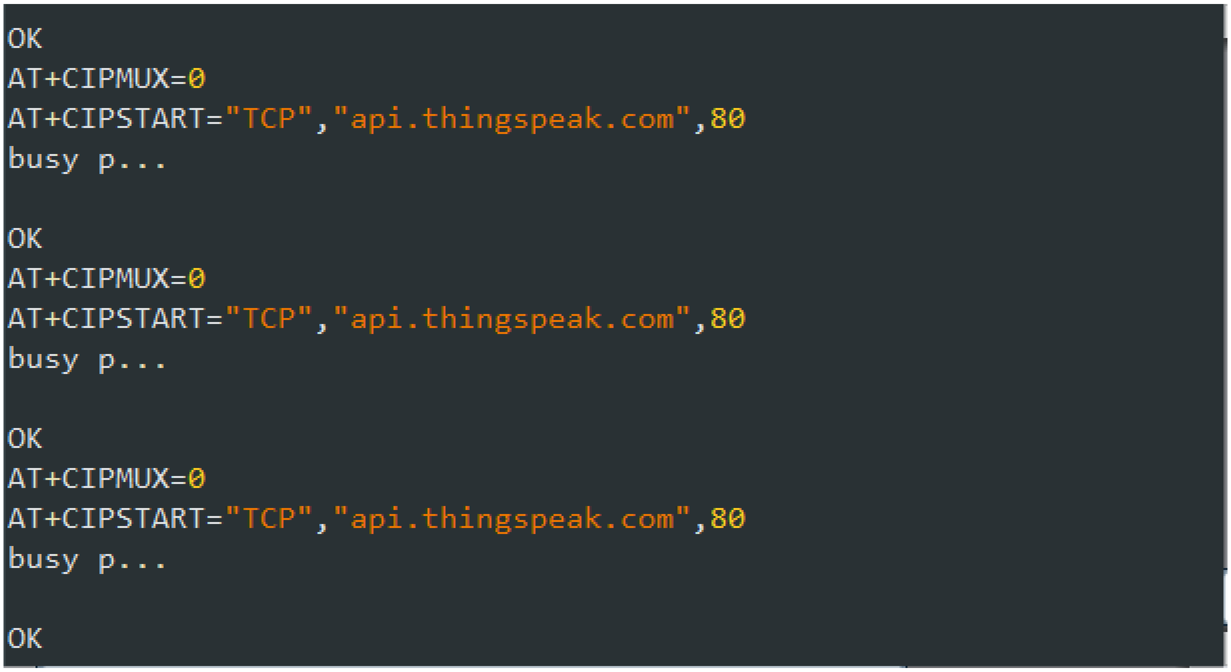
```
busy p...

OK
> QDM8&field1=10
busy s...

Recv 73 bytes

SEND OK

+IPD,288:HTTP/1.1 400 Bad Request
Server: awselb/2.0
Date: Sun, 07 Apr 2019 18:06:36 GMT
Content-Type: text/html
Content-Length: 138
Connection: close
```

Trying to enter another start, send, or get command would lead to getting the “Bad Request” response



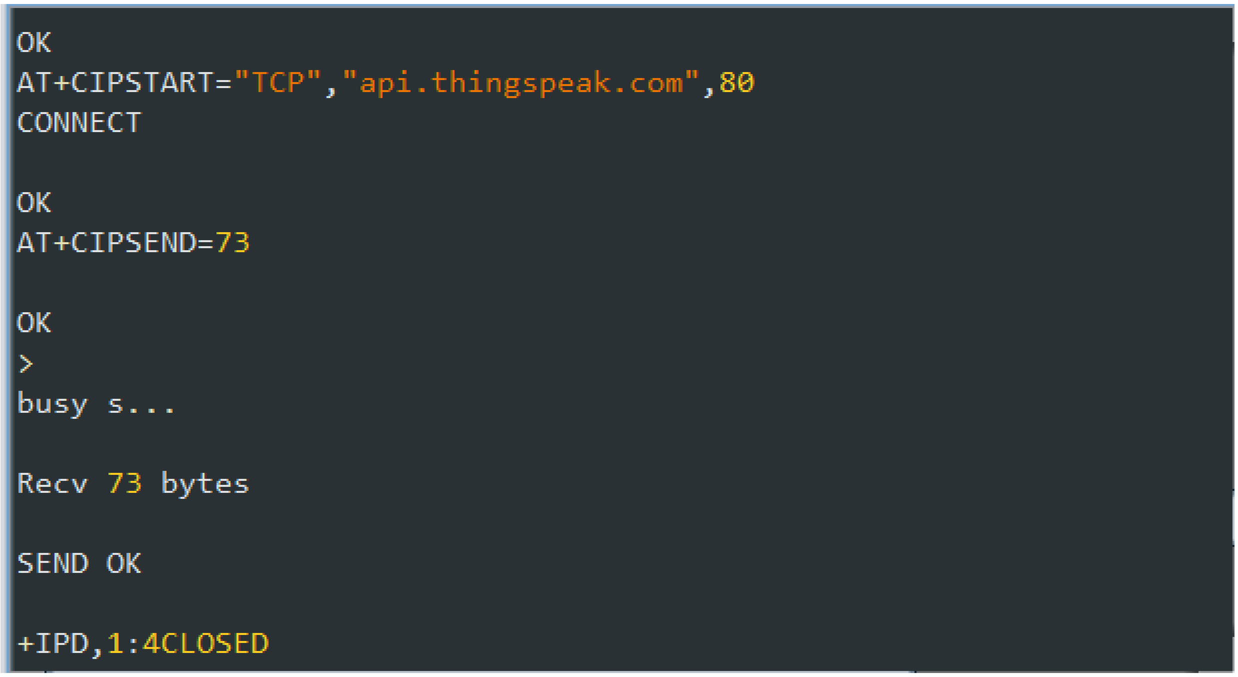
```
SEND OK

+IPD,288:HTTP/1.1 400 Bad Request
Server: awselb/2.0
Date: Sun, 07 Apr 2019 18:06:36 GMT
Content-Type: text/html
Content-Length: 138
Connection: close

<html>
<head><title>400 Bad Request</title></head>
<body bgcolor="white">
<center><h1>400 Bad Request</h1></center>
</body>
</html>
CLOSED
```

More of the “Bad Request” response



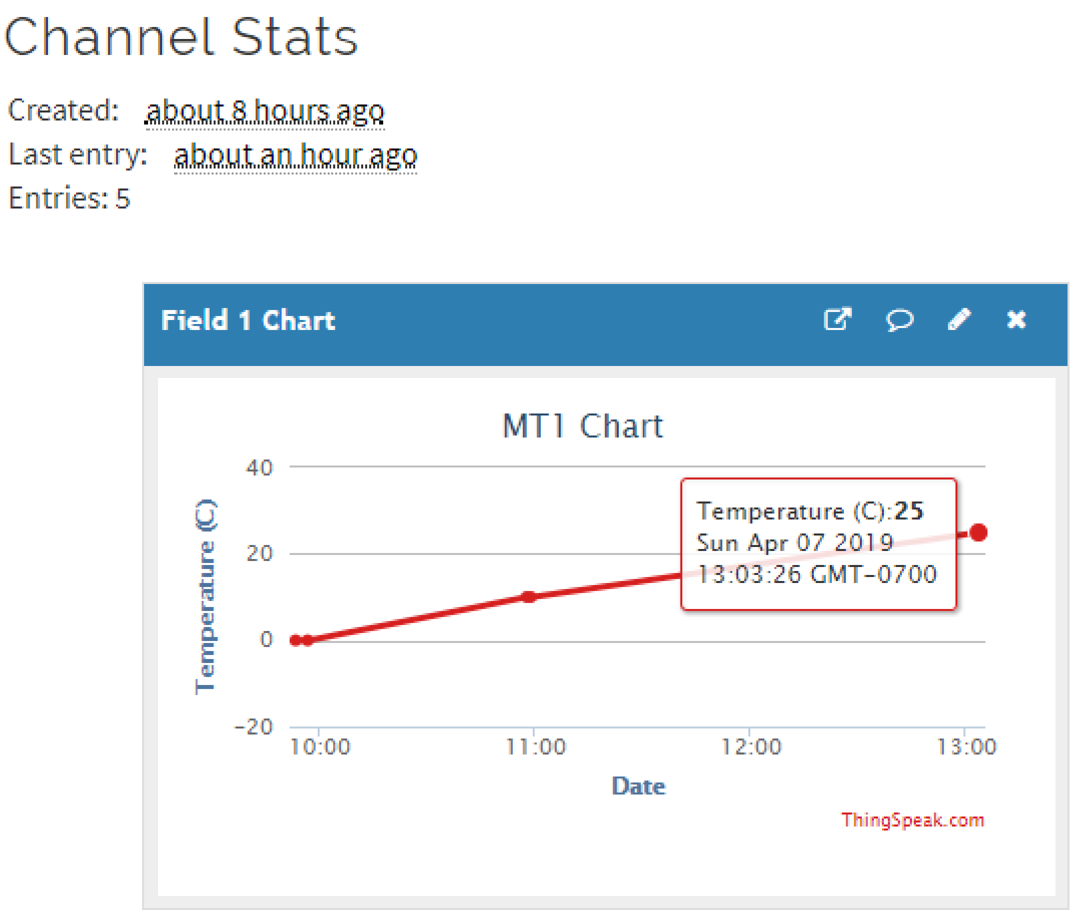
```
OK
AT+CIPMUX=0
AT+CIPSTART="TCP","api.thingspeak.com",80
busy p...

OK
AT+CIPMUX=0
AT+CIPSTART="TCP","api.thingspeak.com",80
busy p...

OK
AT+CIPMUX=0
AT+CIPSTART="TCP","api.thingspeak.com",80
busy p...

OK
```

Example of the start command getting “busy p…” responses



```
OK
AT+CIPSTART="TCP","api.thingspeak.com",80
CONNECT

OK
AT+CIPSEND=73

OK
>
busy s...

Recv 73 bytes

SEND OK

+IPD,1:4CLOSED
```

Example of one of the command sequences being processed successfully



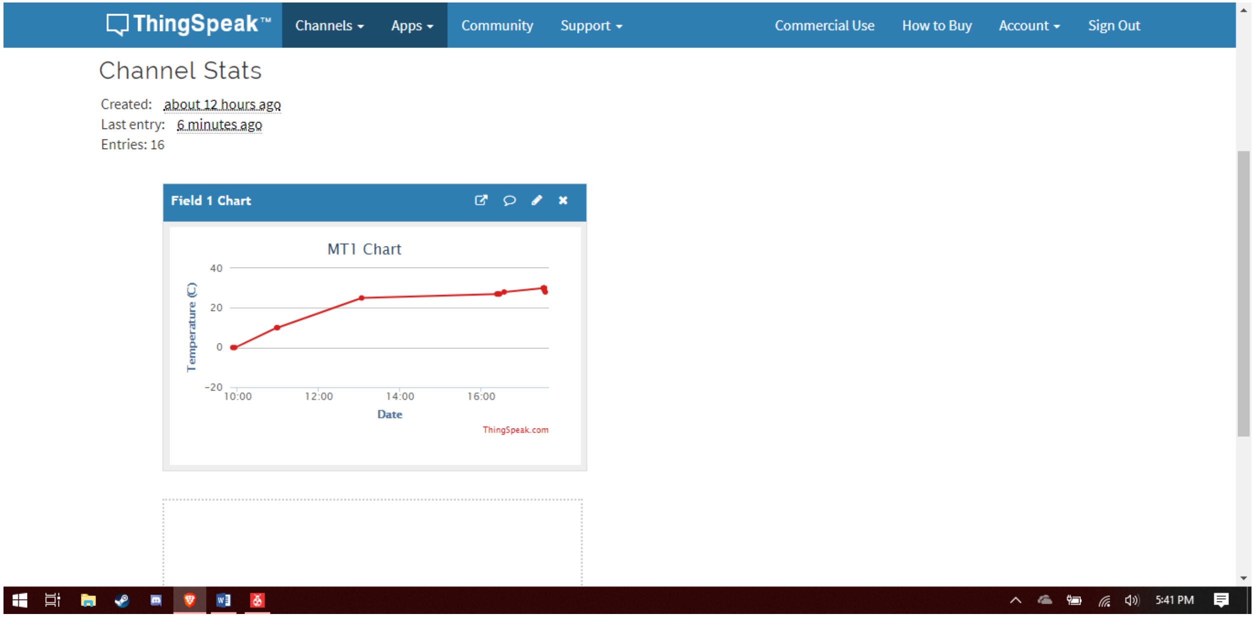
Channel Stats

Created: about 8 hours ago

Last entry: about an hour ago

Entries: 5

Screenshot from 4/7 at 2:23pm of data points. The first 4 values were done testing the ESP-01 module with a USB adapter and ESPlorer to see if I could send values. It was consistently failing to send data and only did so after repeatedly sending the sequence of commands.



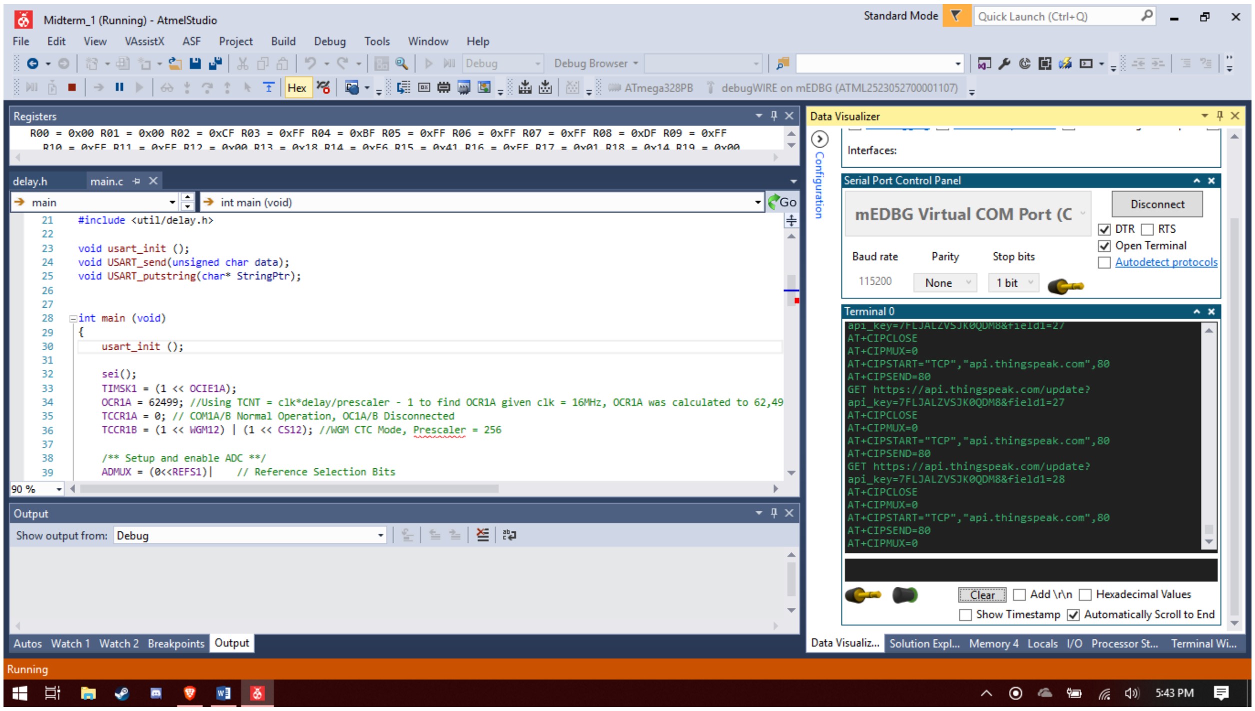
Channel Stats

Created: about 12 hours ago

Last entry: 6 minutes ago

Entries: 16

Screenshot on 4/7 at 5:41pm, the setup on the board was sending data, though inconsistently, having sent about 6 an hour prior to recording the video demonstration then another 5 during.


Midterm_1 (Running) - AtmelStudio
Standard Mode
Quick Launch (Ctrl+Q)
File Edit View VAssistX ASF Project Build Debug Tools Window Help
Debug
Debug Browser
Hex
ATmega328PB
debugWIRE on mEDBG (ATML2523052700001107)
Registers
delay.h
main.c
main
int main (void)
Go
90 %
Output
Autos Watch 1 Watch 2 Breakpoints Output
Data Visualizer
Configuration
Interfaces:
Serial Port Control Panel
mEDBG Virtual COM Port (C
Disconnect
Terminal 0
Clear
Data Visualiz... Solution Expl... Memory 4 Locals I/O Processor St... Terminal Wi...
Running
5:43 PM

```
R00 = 0x00 R01 = 0x00 R02 = 0xCF R03 = 0xFF R04 = 0xBF R05 = 0xFF R06 = 0xFF R07 = 0xFF R08 = 0xDF R09 = 0xFF
  R10 = 0xFF R11 = 0xFF R12 = 0x00 R13 = 0x18 R14 = 0xF6 R15 = 0x41 R16 = 0xFF R17 = 0x01 R18 = 0x14 R19 = 0x00
```

```c
#include <util/delay.h>

void usart_init ();
void USART_send(unsigned char data);
void USART_putstring(char* StringPtr);


int main (void)
{
    usart_init ();

    sei();
    TIMSK1 = (1 << OCIE1A);
    OCR1A = 62499; //Using TCNT = clk*delay/prescaler - 1 to find OCR1A given clk = 16MHz, OCR1A was calculated to 62,49
    TCCR1A = 0; // COM1A/B Normal Operation, OC1A/B Disconnected
    TCCR1B = (1 << WGM12) | (1 << CS12); //WGM CTC Mode, Prescaler = 256

    /** Setup and enable ADC **/
    ADMUX = (0<<REFS1)|    // Reference Selection Bits
```

Show output from: Debug

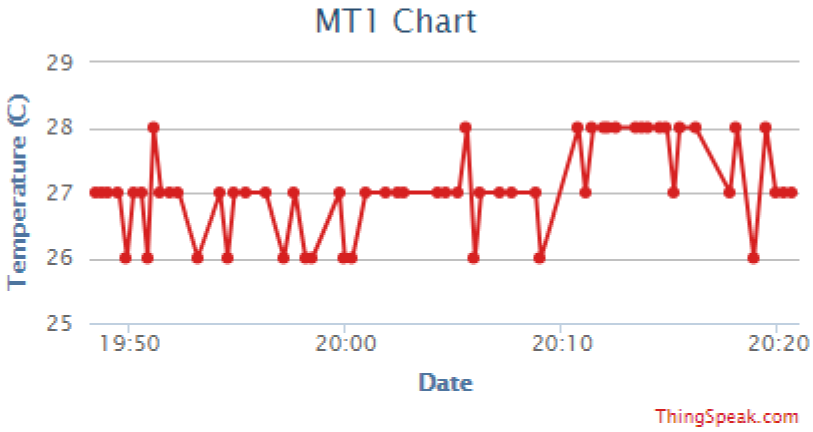
Baud rate: 115200 Parity: None Stop bits: 1 bit

☑ DTR □ RTS
☑ Open Terminal
□ Autodetect protocols

```
api_key=7FLJALZVSJK0QDM8&field1=27
AT+CIPCLOSE
AT+CIPMUX=0
AT+CIPSTART="TCP","api.thingspeak.com",80
AT+CIPSEND=80
GET https://api.thingspeak.com/update?
api_key=7FLJALZVSJK0QDM8&field1=27
AT+CIPCLOSE
AT+CIPMUX=0
AT+CIPSTART="TCP","api.thingspeak.com",80
AT+CIPSEND=80
GET https://api.thingspeak.com/update?
api_key=7FLJALZVSJK0QDM8&field1=28
AT+CIPCLOSE
AT+CIPMUX=0
AT+CIPSTART="TCP","api.thingspeak.com",80
AT+CIPSEND=80
AT+CIPMUX=0
```

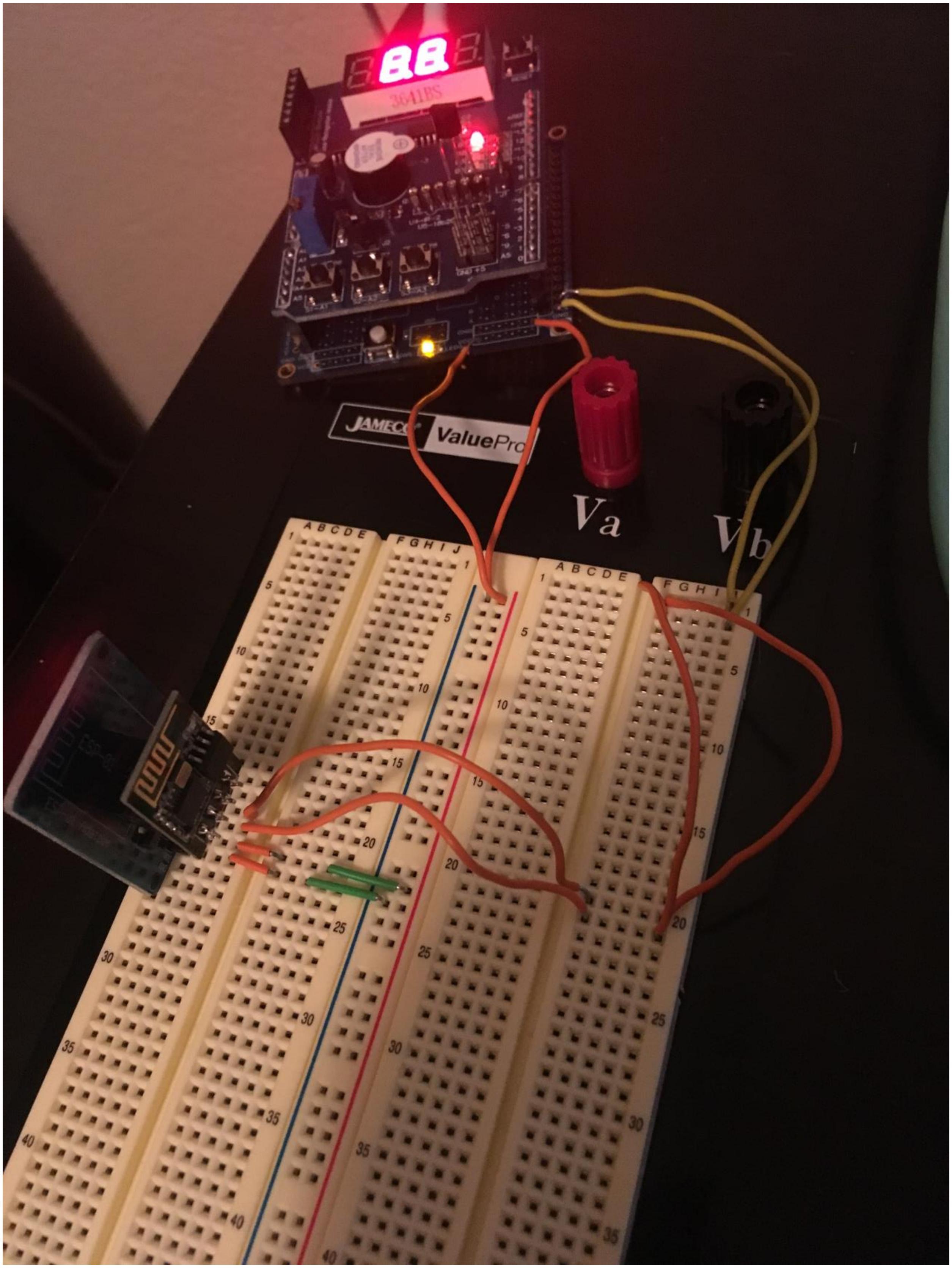
□ Add \r\n □ Hexadecimal Values
□ Show Timestamp ☑ Automatically Scroll to End

Screen capture of the serial output at a 115200 BAUDRATE showing the command sequence being sent to the ESP-01 module.



After changing the write key, the board was sending data every minute or so and after letting it run for a while it wrote a good amount of values.

5. SCREENSHOT OF EACH DEMO (BOARD SETUP)


3641BS
JAMECO ValuePro
Va
Vb
A B C D E
F G H I J

Board Setup, ESP8266 is plugged into ESP01-Adapter which is then connected to VCC and GND on Xplained mini while the TX line from the adapter is connected to RX (PD1) on the Xplained mini and then RX from the adapter to TX of the mini. The Arduino shield is connected on top with the LM35 in U5 of the shield.

6. VIDEO LINKS OF EACH DEMO

https://youtu.be/LP-ESWnX6zo

7. GITHUB LINK OF THIS DA

https://github.com/portig1/submissions_E/tree/master/Midterms/Midterm_1

Student Academic Misconduct Policy
http://studentconduct.unlv.edu/misconduct/policy.html

"This assignment submission is my own, original work".
Geovanni Portillo