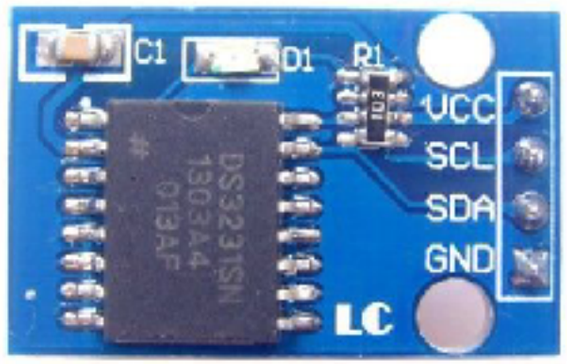
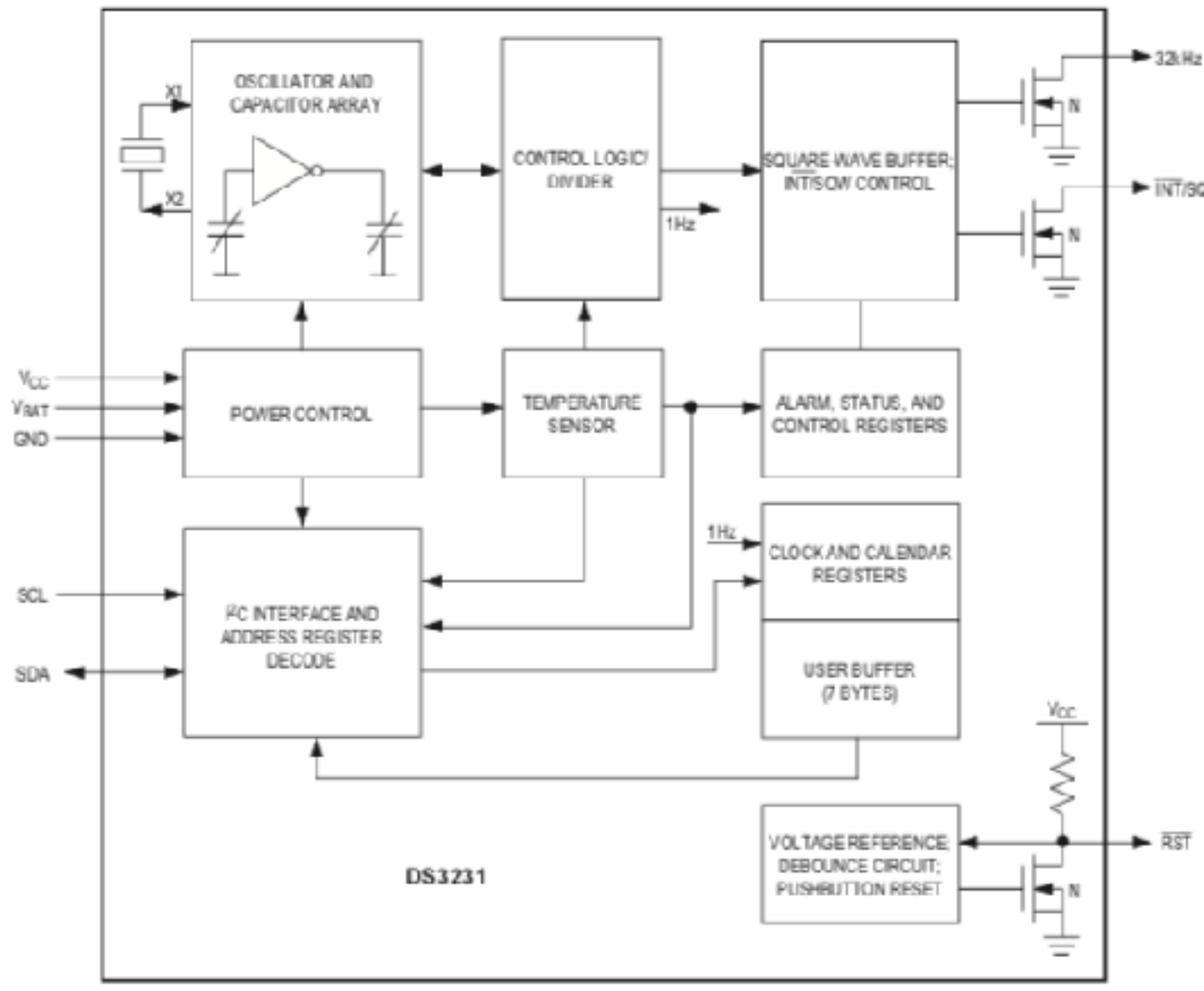
BARSicle

7. Arduino
RTC & OLED

Real Time Clock



- DS3231
  - Counts Sec, Min, Hrs, Date, Mth, DoW, Year.
  - Leap yr compensation
- I2C bus interface
- Built-in 32kHz xtal
- Battery - life > 5yrs, typ 10yr

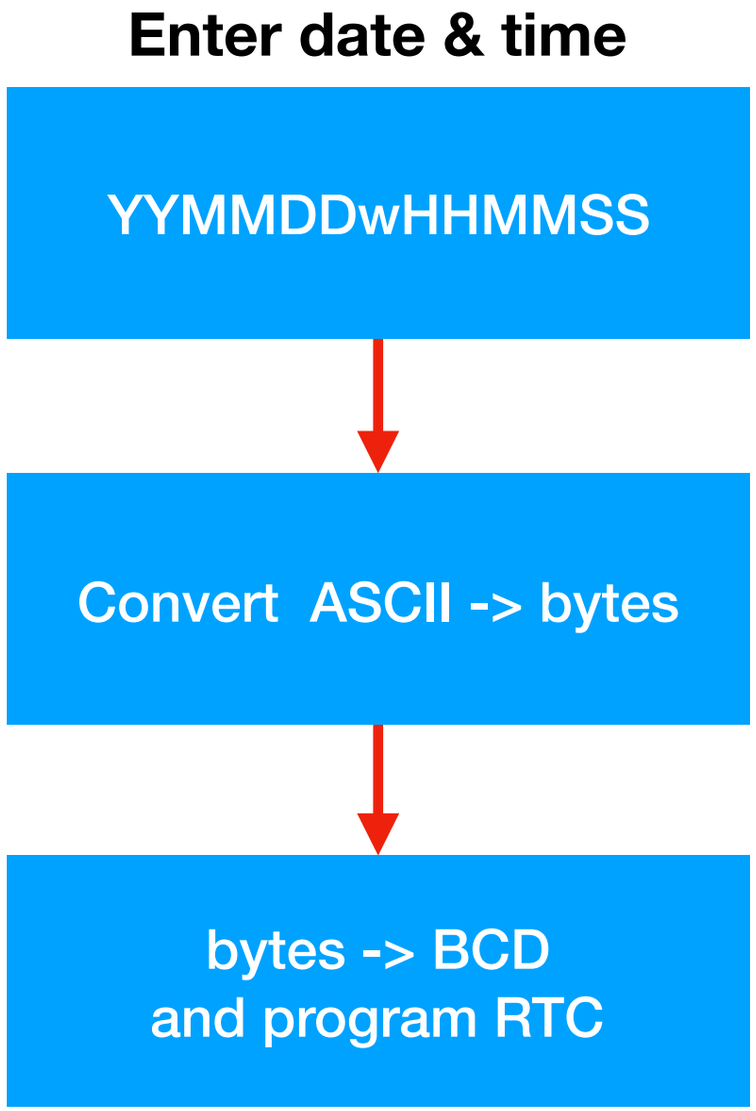


Talks BCD

- The DS3231 uses Binary Coded Decimal
- 1 BCD Byte = 8bits
  - Top 4 bits are 0-15
  - bottom 4 bits are 0-15
- We use decimal!

```
100 byte decToBcd(byte val)
101 {
102   return( (val/10*16) + (val%10) );    // decimal - > BCD
103 }
104
105 byte bcdToDec(byte val)
106 {
107   return( (val/16*10) + (val%16) );    // BCD -> decimal
108 }
109
```

Set the time

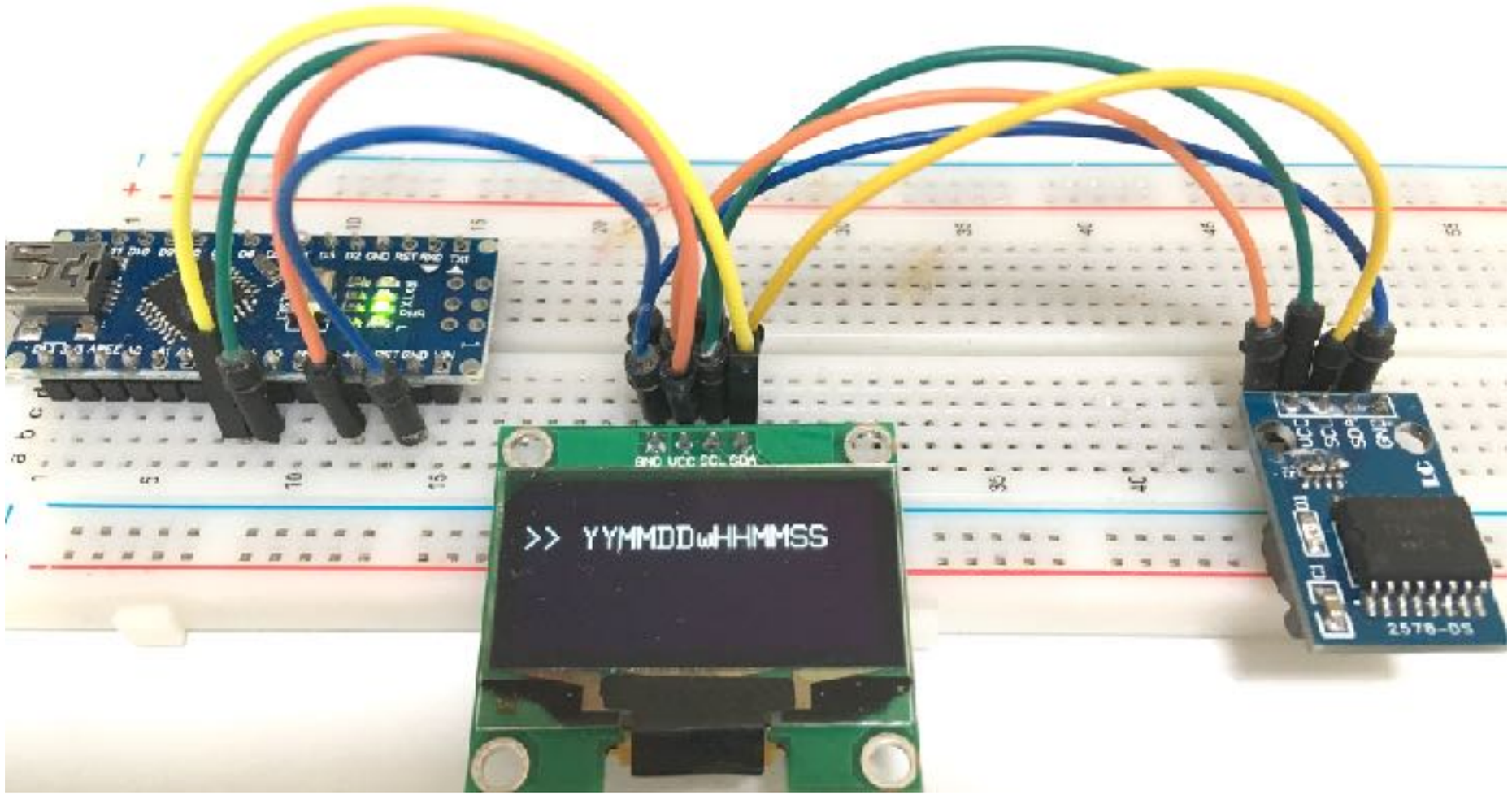



```
54 void asciiToByte() {
55   // convert ASCII rtc buffer string to bytes
56   yr = ((byte)rtcBuf[0] - 48) * 10 + (byte)rtcBuf[1] - 48;
57   mth = ((byte)rtcBuf[2] - 48) * 10 + (byte)rtcBuf[3] - 48;
58   dy = ((byte)rtcBuf[4] - 48) * 10 + (byte)rtcBuf[5] - 48;
59   dow = ((byte)rtcBuf[6] - 48);
60   hrs = ((byte)rtcBuf[7] - 48) * 10 + (byte)rtcBuf[8] - 48;
61   mns = ((byte)rtcBuf[9] - 48) * 10 + (byte)rtcBuf[10] - 48;
62   sec = ((byte)rtcBuf[11] - 48) * 10 + (byte)rtcBuf[12] - 48;
63 }
64
```

```
65 void setRTC() {
66   // program RTC
67   Wire.beginTransmission(RTCADDR);
68   Wire.write(0);                  // next input at sec register
69
70   Wire.write(decToBcd(sec));    // set seconds
71   Wire.write(decToBcd(mns));    // set minutes
72   Wire.write(decToBcd(hrs));    // set hours
73   Wire.write(decToBcd(dow));    // set day of week
74   Wire.write(decToBcd(dy));     // set date (1 to 31)
75   Wire.write(decToBcd(mth));    // set month (1-12)
76   Wire.write(decToBcd(yr));     // set year (0 to 99)
77   Wire.endTransmission();
78 }
```

Let’s go

- Insert battery, +ve side visible, plug in RTC to BB
- Connect VCC/GND & SDA/ SCL
- *File > Sketchbook > My_SET_RTC_OLED*



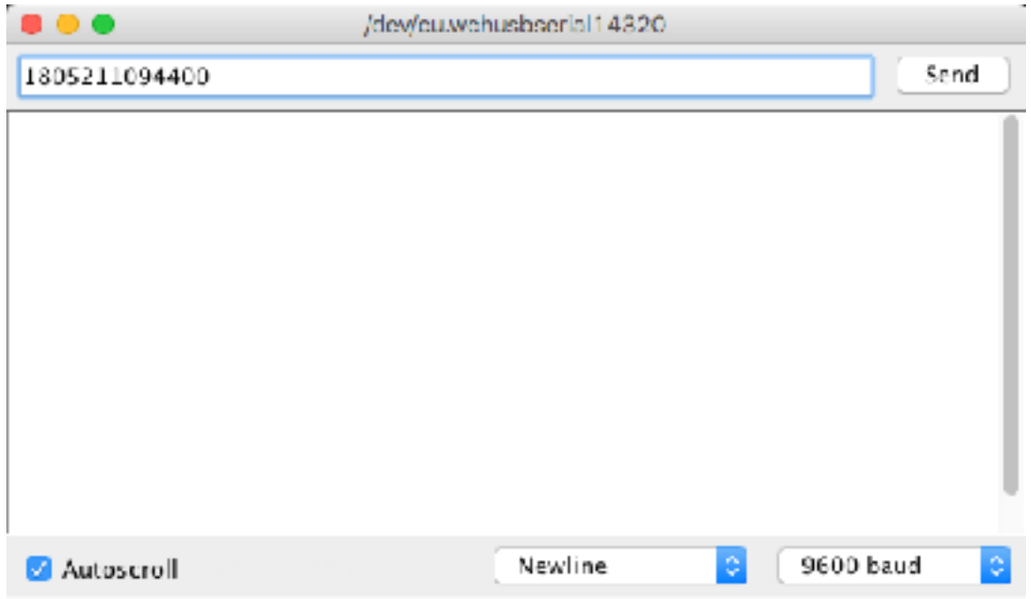
Set the time

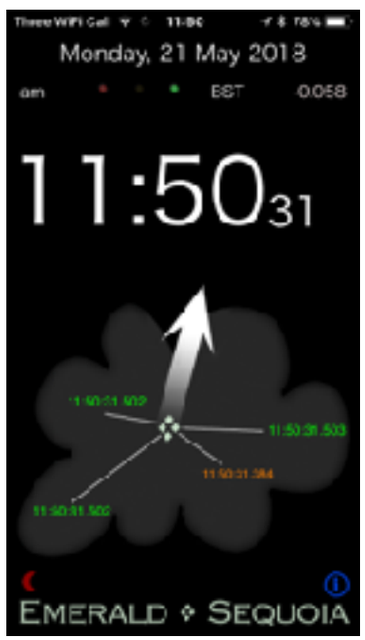
- Enter the date and time

  YYMMDDwHHMMSS

- Year, month, Date
  day of week
  Hour, Minute, Second

- On the exact second you entered hit “Send”





Internet time, PC time

What happens?

1. Nano reads your input message as ASCII into buffer

2. ASCII is converted to decimal bytes

3. Write to RTC in BCD

```
39 bool getMsg(char *m) {                          // get date time string
40   int p;
41
42   if (Serial.available() > 0) {                 // data available ?
43     p = 0;
44     while ((m[p] = Serial.read()) != '\n') {    // end of line?
45       p++;
46       while (!Serial.available());              // wait for next char
47     }
48     m[p] = '\0';                                // terminate string
49     return true;                                // data received
50   }
51   return false;                                 // no data
52 }
```

```
54 void asciiToByte() {
55   // convert ASCII rtc buffer string to bytes
56   yr = ((byte)rtcBuf[0] - 48) * 10 + (byte)rtcBuf[1] - 48;
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75   Wire.write(decToBcd(mth));    // set month (1-12)
76   Wire.write(decToBcd(yr));     // set year (0 to 99)
77   Wire.endTransmission();
78 }
```

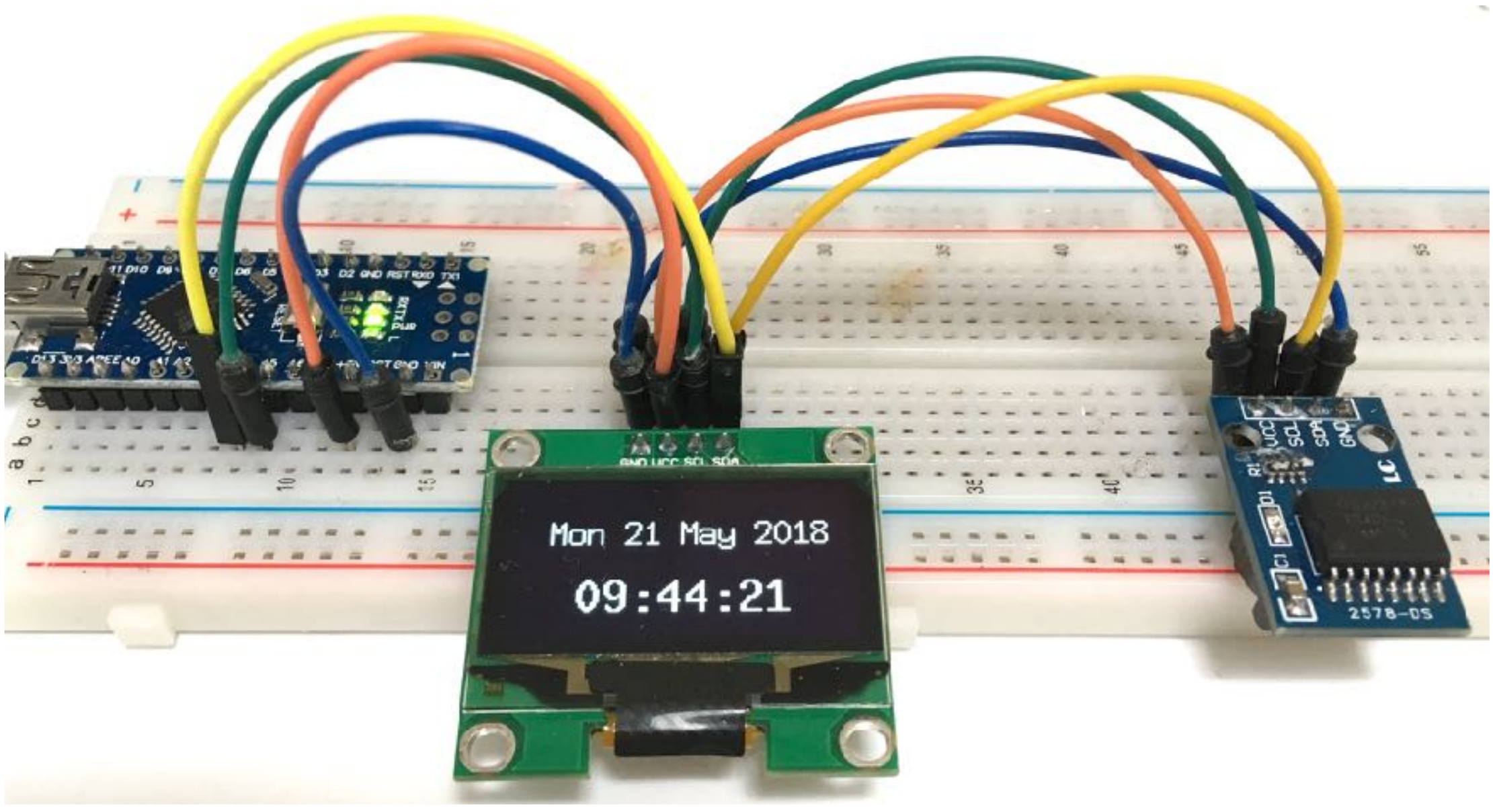
And then?

- Nano reads your input message as ASCII into buffer
- ASCII is converted to BCD bytes
- Write to RTC

```
80 void readRTC() {
81   // Reset the RTC register pointer
82   Wire.beginTransmission(RTCADDR);
83   Wire.write(0x00);
84   Wire.endTransmission();
85
86   // request 7 bytes from the RTC address
87   Wire.requestFrom(RTCADDR, 7);
88
89   // get the time date
90   sec = bcdToDec(Wire.read()); // 0 - 59
91   mns = bcdToDec(Wire.read()); // 0 - 59
92   hrs = bcdToDec(Wire.read() & 0b111111); // mask 12/24 bit
93   dow = bcdToDec(Wire.read()); // 0 = Sunday
94   dy  = bcdToDec(Wire.read()); // 1 - 31
95   mth = bcdToDec(Wire.read()); // 0 = jan
96   yr  = bcdToDec(Wire.read()); // ..yy
97 }
```

```
111 void dispUpdate() {                          // picture loop
112   oled.firstPage();
113   do {
114     if (inString == true) {
115       dispDate(15, 15, dow, dy, mth, yr);  // display date & time
116       dispTimeL(25, 40, hrs, mns, sec);
117     }
118     else {
119       dispMsg(0, 15, ">> YYMMDDwHHMMSS");  // display prompt
120     }
121   } while ( oled.nextPage() );
122 }
```

Result



A simpler sketch to just display date & time is
File > Sketchbook > My_RTC

Simple, eh?