MODULE 3-4
REAL TIME CLOCK
Introduction – Real Time Clock

An RTC is an electronic time keeping device with its own battery. It’s often used in other devices such as a data logger.

Purpose:
• Timestamping
• Event management (helps with power saving)

Features
• Has its own battery
• Keeps time even when the main device is powered off or the batteries are dead
Introduction – Real Time Clock

Event management (helps with power saving)
  • Alarm
  • Timer
Real Time Clock - Alarm/Timer
Real Time Clock - Alarm/Timer

RTC → Wake up! → ZZZ
Microcontroller
Sleep
Real Time Clock - Alarm/Timer

- RTC
- Microcontroller
- Read Sensors
- Read Date/Time
- Write to SD
Real Time Clock - Alarm/Timer

Catastrophic Failure!
WildLogger – Real Time Clock
Real Time Clock - Accuracy
Real Time Clock - Accuracy

10 ppm = loses 0.5 min per month (approx)

20 ppm = loses 1 min per month (approx)

40 ppm = loses 2 min per month (approx)
Real Time Clock - Accuracy
Real Time Clock Accuracy
Module 3-4
Real Time Clock
Lab 4a
What Time Is It?
Lab 4a – What Time Is It?

Goal:
• Install real time clock library
• Set time and date
• Read time and date
Lab 4a – What Time Is It?

Why do I need to know this?

• Timekeeping will be critical to the WildLogger functionality
• Reading time will be used to timestamp data
• Timekeeping useful in many other applications, esp. low power ones
Lab 4a – What Time Is It?

What do I need to know?

- Install PCF8563 real time clock library manually
- **Rtc_Pcf8563 rtc**
  - Creates a real time clock (RTC) object
- `rtc.setDate(day, weekday, month, century, year);`
  - We can set century to 0 for 20xx
- `rtc.setTime(hour, minute, second)`
  - Note: hour is in 24-hour format
Lab 4a – What Time Is It?

- `getWeekday()`, `getDay()`, `getMonth()`, `getYear()`
  - Gets the numerical (integer) value for each

- `getSecond()`, `getMinute()`, `getHour()`
  - Gets the numerical (integer) value for each

- `char *rtc.formatDate(format)`
  - Returns the date in a pre-formatted string mm/dd/yyyy
  - Can change format also:
    - `RTCC_DATE_CZ` - dd.mm.yyyy
    - `RTCC_DATE_ASIA` - yyyy-mm-dd (what we'll use)
    - `RTCC_DATE_WORLD` - dd-mm-yyyy
    - `RTCC_DATE_US` – mm/dd/yyyy (default)

- `char *rtc.formatTime()`
  - Returns the time in a pre-formatted string hh:mm:ss
Lab 4a – What Time Is It?

• `rtc.setDate(day, weekday, month, century, year);`

  Week Day
  - Sunday = 0
  - Monday = 1
  - Tuesday = 2
  - Wednesday = 3
  - Thursday = 4
  - Friday = 5
  - Saturday = 6

  Day of the month
  - As per calendar day (1 – 31)

  Month of the year
  - As per calendar month (1-12)

  Century
  - 0 = 2000
  - 1 = 1900

  Year
  - Last two digits of calendar year (0-99)
Lab 4a – What Time Is It?

- `rtc.setTime(hour, minute, second)`

  * `Hours (00), minutes(00), seconds(00)`
  * *eg. 12:34:21*

24 hours
- 12am = 00
- 1am = 01
- 2am = 02
- 3 am = 03  etc

- 12 noon = 12
- 1pm = 13
- 2pm = 14
- 3pm = 15 etc
Manually Installing an Arduino Library

https://github.com/elpaso/Rtc_Pcf8563
Manually Installing an Arduino Library

/Documents/Arduino/libraries

~/Arduino/libraries

Mac + Windows: /documents/Arduino

Linux: ~/Arduino
Lab 4a

Real Time Clock

```c
#include <Rtc_Pcf8563.h>

Rtc_Pcf8563 rtc;

void setup() {
    // put your setup code here, to run once:
    Serial.begin(57600);
    Serial.println("Module 3, Lab4a - What Time Is It?");

    rtc.setDate(19, 6, 12, 0, 20);
    rtc.setTime(18, 50, 0);

    Serial.println(rtc.formatDate());
    Serial.println(rtc.formatTime());
}

void loop() {
    // put your main code here, to run repeatedly:
}
```
Module 3-4
Real time clock

Lab 4b
Command Line Time and Date
Lab 4b – Command Line Time

Goal:

• Create a command that sets the time
• Create a command that sets the date
• Create a command that prints out the time
• Create a command that prints out the date
Lab 4b – Command Line Time

Why do I need to know this?

• Extremely useful to have a command to set time and date. Usually just done once before deployment

• Test out our time and date format as a timestamp
Lab 4b – Command Line Time

What do I need to know?

Nothing!
Lab 4b

Command Line Time and Date

#include <Rtc_Pcf8563.h>
#include <cmdArduino.h>

Rtc_Pcf8563 rtc;

void setup() {
  // put your setup code here, to run once:
  cmd.begin(57600);
  Serial.println("Module 3, Lab4b - Command Line Time and Date");
  cmd.add("settime", cmdSetTime);
  cmd.add("setdate", cmdSetDate);
  cmd.add("gettime", cmdGetTime);
  cmd.add("getdate", cmdGetDate);
}

void loop() {
  // put your main code here, to run repeatedly:
  cmd.poll();
}
Lab 4b

Command Line

Time and Date

This code goes after the loop function...