MODULE 3-3
MEASURING BATTERY STATUS USING THE ANALOG TO DIGITAL CONVERTER
What’s an Analog to Digital Converter

**Physical Property** → **Sensor** → **Voltage** → **Conversion**

- What's an Analog to Digital Converter
- PHYSICAL PROPERTY
- SENSOR
- VOLTAGE
- CONVERSION

- Examples of physical properties and their corresponding sensors and voltage conversion.
Analog to Digital Analogy
What Is Analog to Digital Conversion?

94 dB re 20 μPa (= 1 Pascal)
WildLogger – 10 bit ADC
WildLogger – 10 bit ADC
Module 3-3
Analog to Digital Converters
Lab 3a
Checking Battery Status
Lab 3a – Checking Battery Status

Goal:

- Read battery value from ADC
- Perform calculations to convert that to actual battery voltage
3.3v
3.6v
5.5V

Battery Voltage Range

 ADC Range

5.5V
3.6v
3.3v

Battery Voltage Range

Scaling: Divide by 2
Lab 3a – Checking Battery Status

Why do I need to know this?

• For outdoor, environmental monitoring, #1 issue is battery life
• Keeping track of battery performance will allow us to optimize size & number of batteries
• Can also take actions based on battery charge level
Lab 3a – Checking Battery Status

![Coppertop AA Constant Current Graph](image-url)

- Voltage vs. Service Hours for different currents (5 mA, 10 mA, 25 mA, 50 mA)
Lab 3a – Checking Battery Status

What do I need to know?

• No libraries needed for this lab

• \texttt{analogRead(pin)}
  • Returns an int value corresponding to the voltage the ADC sees

• **Voltage calculation:**
  • Battery voltage = \((\text{ADC value}) \times (\text{ADC Reference Voltage} \div \# \text{ADC levels}) \times \text{Scale factor})
    • ADC Reference Voltage = 3.3V
    • \#ADC Levels = 1024
    • Scale Factor = 2
Lab 3a

Battery Status

```c
#define ADC_UNITS 1024  
#define ADC_REF_VOLTAGE 3.3  
#define ADC_SCALE_FACTOR 2  

int pinBatt = A6;  

void setup()  
{  
  pinMode(pinBatt, INPUT);  
  Serial.begin(57600);  
  Serial.println("Module 3-3 Lab 3a: Battery Status"); 
}

void loop() {  
  int battAdc = analogRead(pinBatt);  
  float mVPerUnit = ADC_REF_VOLTAGE / ADC_UNITS;  
  float battVoltage = battAdc * mVPerUnit * ADC_SCALE_FACTOR;  
  Serial.print("Raw ADC value: ");  
  Serial.print(battAdc);  
  Serial.print(" Battery Voltage: ");  
  Serial.println(battVoltage);  
  delay(1000); 
}
```

Module 3-3
Analog to Digital Converters
Lab 3b
Give Me Your Voltage, I Command You!
Lab 3b – Command Line Battery Status

Goal:

• Create a command on the command line to read battery status
Lab 3b – Command Line Battery Status

Why do I need to know this?

- Building up our test environment for our application
- Functional block development
- Interactive test application
Lab 3b – Command Line Battery Status

What do I need to know?

• Nothing new for this lab
Lab 3b

Command Line Battery Status
COMING UP
Module 3-4: Real Time Clock