Electrical and Computer Engineering Capstone Requirements/Specifications

Version 1.1

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**Erebus Labs**

**Open Sensor Platform**

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**Introduction**

Our goal is to develop and prototype an inexpensive and accessible solution to collect data points of one or more sense-able physical attributes over an arbitrary duration of time. For more information, please refer to the project proposal document.

**Requirements**

# Function

## Configuration

### Must: Be able to configure device operating parameters…

#### Must: … using low level capabilities (e.g. write a script).

#### Should: … using mid-level capabilities (e.g. using command line functions).

#### May: … using high level capabilities (e.g. using a GUI).

### Should: Be able to reconfigure parameters in the field (e.g. using a portable computer with USB port.

### Parameters that may be configured:

#### For each sensor:

#### Must: Polling frequency for each sensor.

#### Must: Interrupt condition (to take a measurement) for each sensor.

#### Should: Out-of-range threshold(s) for each sensor.

#### For the system:

#### Should: Low power indicator threshold.

#### Should: Low storage indicator threshold.

#### Should: Continuous recording Vs. End when out of memory. (keep latest data vs. keep first data)

#### May: Conditional data logging, e.g.:

##### Only log within a time window.

##### Only log within repeating time windows.

##### Log conditional on a sensor value.

##### Log conditional on the power level.

## Feedback

### Device must be able to give feedback for certain conditions:

#### Must: Sensor read error.

#### Must: IO busy/idle (do not remove storage device).

#### Should: Low power.

#### Should: Low storage.

#### Should: Sensor value out of threshold.

## Data Collection

### Must: Be able to collect values from sensors designed for this system.

### Max number of attached sensors supported:

#### Must: 4 sensors.

#### Should: 8 sensors.

#### May: 16 sensors.

### Max number of stored sample values:

#### Must: 10 million samples.

#### Should: 100 million samples.

#### May: 1 billion samples.

### Maximum sampling rate:

#### Must: 100 samples / second.

#### Should: 1000 samples / second.

#### May: 10000 samples / second.

## Data Retrieval

### Must: Be able to retrieve recorded data from the device.

### Should: Retrieve data without interrupting service (e.g. swap out SD cards).

### May: Be able to retrieve data without physical access to device (e.g. wireless retrieval; See note 1).

## Data Analysis

### Should: Translate retrieved values into values meaningful to the user.

### Should: Provide a simple tutorial on graphing the data in a spreadsheet.

# Power

## Must: Be able to be powered by an external power source without risking damage to the device with reasonable excess voltage.

## Must: Handle low voltage/current supply conditions without losing data or adversely affecting the firmware.

## Should: Achieve power efficiencies suitable to run the device for extended periods of time on a reasonably sized battery pack (See note 2).

# Unit cost (See note 3)

## Must: < $50 per unit.

## Should: < $30 per unit.

## May: < $15 per unit.

# Misc.

## Open Source

### Must: Implement open source hardware, firmware, and software.

## Post-design availability

### Must: Provide prototype units for each team member and each sponsor (5).

### Should: Must +5 extras (10).

### May: Must +10 extras (15).

## Community Outreach

### Should: Apply partnership building with a local K-12 school; Flexible options include teacher conversations, lesson development, and/or helping with a lesson stemming from this research.

**Notes**

Note 1: It is highly unlikely we will get around to wireless data retrieval by June, however we can leave the infrastructure in place to implement this feature later.

Note 2: Since we have decided to power the device externally, in order to set any duty cycle requirements, we would need to base it on using specified power source. A 3200mAh battery seems reasonable, but we need more information and research to come up with even a ballpark estimate of a duty cycle. We don't feel this should warrant obstructing progress at this point. Basically, if it doesn't last long enough in the field, we just get a bigger battery.

Note 3: A unit is being defined as the cost of the main device and configuration software to the end consumer, without sensors or accessories.

**Revision History**

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| --- | --- | --- | --- |
| Version | Date | Author | Comment |
| 1.0 | 2/22/2015 | Colten Nye | Initial creation |
| 1.1 | 6/7/2015 | Golriz Sedaghat | Modifying the formatting |