Temperature Sensor Requirements

(http://kdobrien.github.io/Projects/EnvironmentalMonitor/)

Service environment temperature sensor

Test and measurement equipment is subject to a periodic *calibration* to verify that the equipment is performing within specified limits. Equipment performance changes over time due to internal component aging or failure which requires periodic verification and adjustment.

One of the requirements for calibration of test and measurement equipment is that the temperature of the area where a calibration is performed must be maintained within a specified temperature range. The temperature of the calibration area affects the accuracy of the calibration and an uncontrolled environment leads to reduced calibration accuracy and quality.

Each site sets a minimum and maximum temperature limit and checks the environment to ensure the limits are not exceeded. This process varies between sites and the actual temperature during a calibration is not easily available to the person doing a calibration.

This project will create a low cost temperature sensor that can be deployed to measure and report the temperature for each area of the service center. The number of sensors at a site can be adjusted based on the size of the site and the physical characteristics of the building (i.e. open space or individual rooms). Once temperature data is stored in electronic form, the current temperature can be made available to the operator and calibration software for improved quality.

The sensor will have one indicator to indicate status and one button to trigger a verification. Details are given below.

Constraints

The following constraints have been placed on this project:

- Material cost must be less than $50. Preferred cost is less than $30 dollars.
- The sensors must provide an in-place verification process so that sensor accuracy can be demonstrated to auditors.
- The standard site public WiFi network will be used (standard network configuration).
- Sensors must be able to run 24x7, so AC power is a requirement.
- Temperature accuracy must be better (less) than 3°C and preferably less than 2°C.
- Temperature readings must be reported at a rate of 5 minutes/reading or better. A measurement rate of 3 minutes/reading is preferred.
- Temperature data must be transferred to the appropriate environmental data collection web server (site specific) using the provided API.
- The design and prototype must be completed in 4 weeks. Packaging of the sensor (case, etc) will be undertaken once the prototype is accepted.

User perspective

Each site must decide how many sensors are required to adequately monitor the calibration areas. Enough sensors must be used to accurately monitor the temperature for each calibration area.

Sensor installation:

- Note the sensor identifier printed on the back of the sensor.
- Attach the sensor to a wall or column at least 0.5m from the ceiling and about 2m from the floor. Avoid locations that are near or subject to airflow from heating/cooling sources. Use a temporary mounting method until the verification step in case the sensor needs to be relocated.
- Connect the sensor to power and observe the indicator (led) on the sensor. The sensor will join the site public WiFi network and then locate a environmental data collector server for reporting temperature data.
  - A slow flashing indicator indicates the sensor is configuring or has lost network connection.
  - A quickly flashing indicator means that configuration failed. Refer to appendix A to correct the configuration.
  - The indicator will remain lit except for a single flash (off) once every 3 minutes when a measurement is taken.
- Configure the sensor on the environmental data collection server. Set a location identifier and description for the sensor identifier noted in the first step.
- Allow the sensor to operate for at least 30 minutes while it adjusts to the local temperature.
- Use a hand held temperature meter to determine the temperature of the calibration area.
- Press the button on the sensor to generate 10 verification measurements.
- Use the environmental data collection server to access the verification measurements. If the verification values are more than 3°C from the measured (average) value, the sensor must be relocated to a more representative location.

Sensor operation:

Sensor operation is automatic once installed. The sensor will send a temperature measurement to the environmental data collection server once every 3 minutes.

The indicator on the sensor will remain lighted except for a brief flash (off) about once every 3 minutes when a measurement is taken.

If the indicator flashes slowly, a network interruption has occurred or the sensor is powering up. This condition should resolve once the network connection is made and the indicator will switch to a steady on state.

A quickly flashing indicator indicates a problem with the sensor that should be reported to site support.

Designer perspective

Each sensor must have a unique identifier so that reported temperature values can be associated with the area where the sensor has been deployed. This is not expected to be a user configurable value and mapping of the sensor identifier to an area will be handled by the data collection system.

Each sensor will send an updated temperature (and optional relative humidity) value every 3 minutes. If the network is temporarily unavailable, the temperature values will be held (volatile storage) to send once the network connection is re-established. Note that each measurement must have a timestamp to ensure that saved values can be correlated to the time they were taken.

Setting up a new sensor should require minimal or no effort for service centers within the corporate intranet. Use of the central autoconfig server is recommended to map the sensor identifier/network address to the appropriate environmental data collection server.

Each sensor should have a simple means (i.e. a button to push) that will trigger a series of 10 measurements. These measurements will be submitted as verification measurements to check repeatability and to allow the site to compare the measured values to an external device (i.e. a calibrated hand held temperature meter). The time between measurements should be no less than 3 seconds and no more than 30 seconds (all sensors must use the same interval that will be set during design).

Environmental Data Collection Server

The format and parameters of the specific URLs for the autoconfig server and environmental data collection server will be documented in the design process. Both servers use a simple HTTP protocol for the API.

Appendix A Configuration Issues

The temperature sensor uses a well known autoconfig server to determine the name and IP address of the environmental data collection for the site.

If the indicator is flashing quickly, it indicates that the network connection has failed or there is no configuration data for the site.

Contact local support for further troubleshooting or to create configuration data for the site. *Make sure you supply the sensor identifier* with the request.