BUILDING PERFORMANCE LAB
CUNY INSTITUTE FOR URBAN SYSTEMS
CITY UNIVERSITY OF NEW YORK

BASAT Product Definition

Enabling Advanced Building Automation in Existing Buildings

Product Definition for the Building Automation System Assessment Tool (BASAT)

Prepared by

Stephen Samouhos, PhD
Christopher Petrone
Carol Brito
Michael Bobker

Prepared under contract with

NYSERDA
Anthony Abate, Project Manager

BASAT is intended to be a simple form-based tool for helping building owners, managers, contractors and engineers assess their BAS infrastructure and determine what additional benefits they could get from their BAS. These additional benefits often require infrastructure improvements to the BAS, and so the product is intended to suggest benefits as well infrastructure improvements needed to realize those benefits. The tool includes an intelligent spreadsheet tool (with an embedded decision matrix) that will automate some of the evaluation of observations made during a BAS assessment, as well as a process protocol to guide the user through examining a BAS. We envision this tool to be included within typical free "walk-through" evaluations of BAS infrastructure that are often provided by consultants and vendors before they commit to a more in-depth and specific project evaluation.

Commented [AWA1]: Does form = checklist type of thing? Form driven decision matrix?

The prototype version of BASAT will focus on integration of fault detection and diagnostic (FDD) benefits into the BAS. FDD is a very popular contemporary technical area within BAS development because it extends to the ability of the BAS to actually diagnose the malfunction of itself and its components. Notwithstanding its popularity, this particular topic was chosen for the BASAT prototype because there is a direct physical relationship between equipment and system FDD and BAS sensors inputs. Relative to tool design, we can easily define input-output relationships between sets of existing BAS sensors, FDD algorithms, and sensors that can be added to a BAS to enable more FDD.

The vision for this prototype is a survey tool that engineers can use during their assessment of a BAS, where lists of existing BAS sensors can be input into the tool, and a report is automatically generated outlining FDD applications for that building. Our goal is to generate a simple report that outlines FDD applications that can be immediately deployed with existing BAS infrastructure, and enhanced FDD that can be applied with specific BAS infrastructure improvements.

Commented [AWA2]: I think the 'how' part of this function is important to the def. Are these outcome simply things that any good buildings controls engineer would conclude should be done?

The BASAT prototype will be built into a spreadsheet tool, with a graphic user interface and code written in visual basic (VB). This software platform was chosen for ease of distribution to many computers and users, and ease for rapid prototyping, continued development, and portability to more scalable on-line platforms such as ASP.NET.

Commented [AWA3]: fine

The prototype tool will have 3 primary graphic interfaces:

1. Administrative interface for inputing basic project and surveyor information
2. System and sensor selection input for choosing a system to survey and a selecting the sensors that are found to exist in that system
3. Final report interface that includes the auto-generated output from the tool, as well as fields for custom survey comments, and buttons for printing the report to a PDF

The internal architecture of the tool will be designed for extensibility to additional sensors, building systems and fault detection algorithms as needed. As a consequence, the analytical logic of the tool will be abstracted into a series of constructors that take generic list arguments and references to extensible system libraries in order to assemble the reporting output. The general framework of the tool will therefore be applicable to many different types of systems, sensors, and BAS "benefit functions" for evaluation. A summary of the architecture and interfaces of the tool are shown in figure 1 with a more detailed functional requirements specification in the remaining body of this document.

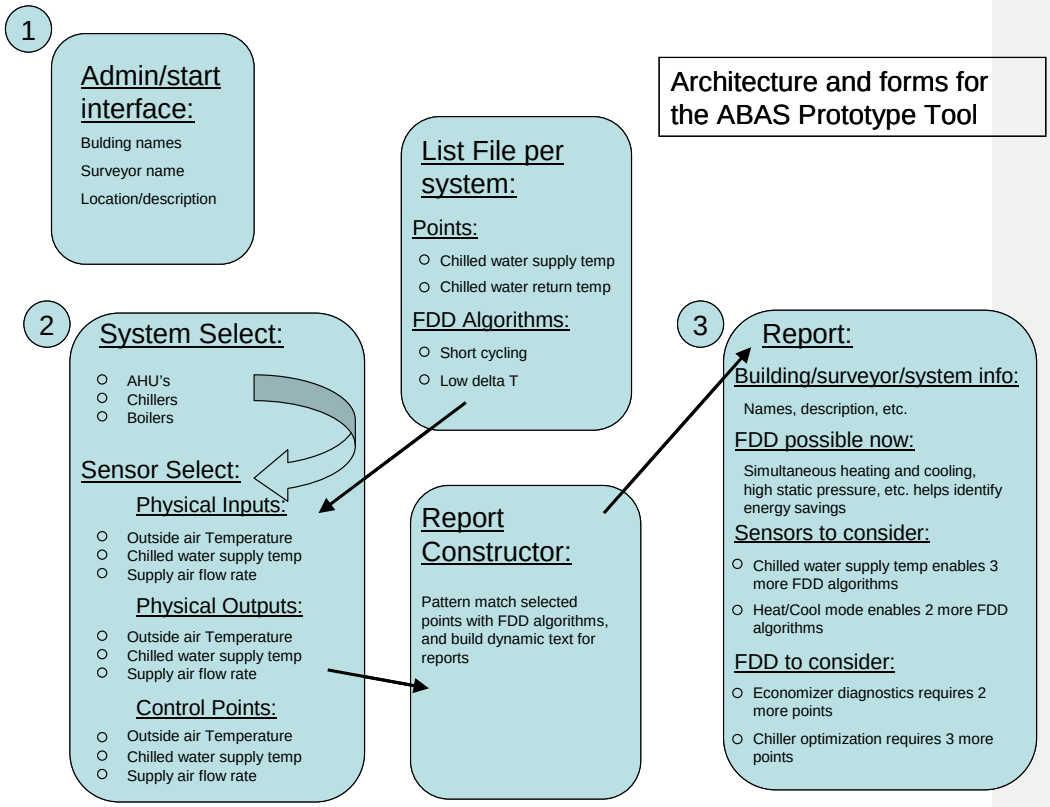

Figure 1 Numbered windows indicate the actual views that the user sees and fills in. These include administrative, system selection and reporting interfaces. Other function blocks shown here represent internal files for the tool

The typical use case for the BASAT tool starts with form 1, where the user enters administrative information about themselves and the site where they are working. The user then proceeds to select the system that they are studying from a fixed list of options. Following a system selection, form 2 brings the user through a series of form screens where the user can click multiple radioboxes corresponding to the sensors that the BAS has for the system under study. The user can execute this process for multiple systems, one after the other, until they have assessed all of the building systems that can be affected by the BAS. Once form 2 is complete, the user will press a "generate report" button that will transfer the user to reports form. The reports form will include a summary of information about the building as well as BASAT analysis results about the site.

Prototype Feature requirements:

1. Administrative VB form interface for inputing:
    a. Building information:
        i. Name, address, age, description
    b. Surveyor information:
        i. Name, company, contact email, contact phone number
    c. Control system information:
        i. Manufacturer, software product name, age
    d. Save button that leads to sensor input VB form

2. Sensor Input VB form interface for inputing:
    a. Single-select radiobuttons to choose the system being surveyed
        i. Choose from a pre-defined list file
            1. System examples include air-handlers, boilers, etc.
        ii. Upon selection, raise message box to collect system information
            1. nameplate capacity, description
        iii. Upon message box close, update bottom of form with list of sensors from corresponding list file, and gray out top of form for system selection
    b. Multi-select radiobuttons on bottom of form for choosing the sensors that exist in the system under study
        i. Sensors will be named according to a common convention
        ii. Sensors are organized into 3 sections:
            1. Physical inputs
            2. Physical outputs
            3. Software control points
        iii. Sensor list file is structured according to those 3 sections, and is fully extensible in the future
    c. "Next" click button opens reporting form
        i. Upon Next, selected and not-selected sensors are stored in separate arrays, and passed to a report constructor
        ii. Report constructor compares selected and un-selected sensors with a list file of FDD functions
            1. pattern matching
                a. identifies FDD algorithms that are possible with existing infrastructure
                b. identifies sensors most needed to enable more FDD
                c. identifies FDD algorithms that are possible with incremental addition of sensors
            2. dynamic text assembly based on pattern matching results for a 'plain english' report
            3. results are passed to the report VB form

3. Report VB form
    a. Present administrative information and system selection as collected from previous form
    b. Present system information text
    c. Present report constructor results:

Commented [AWA4]: Is there such a 'list'. Are there such standard FDD practices that should be referenced in the whitepaper?

   i. Text section for FDD algorithms possible with existing sensors
   ii. List of sensors to add to the BAS, ranked by the # of FDD algorithms where they can be applied
   iii. List of FDD algorithms that can be used if sensors are added to the BAS, ranked by the least # of sensors needed to realize the algorithm
d. Present list of selected sensors from sensor input form
e. Include additional comments text box for surveyor to add customized notes
f. Include a print button to print form as PDF or from printer