University of Idaho
Idaho Falls

CAES
Center for Advanced Energy Studies

INL
Idaho National Laboratory

TARGETED ENERGY MANAGEMENT SYSTEM TOOLS FOR BUILDING MANAGERS

University of Idaho
HRG
Modern Heuristics Research Group
http://mhrg.if.uidaho.edu

Instrumentation Control & Intelligent Systems

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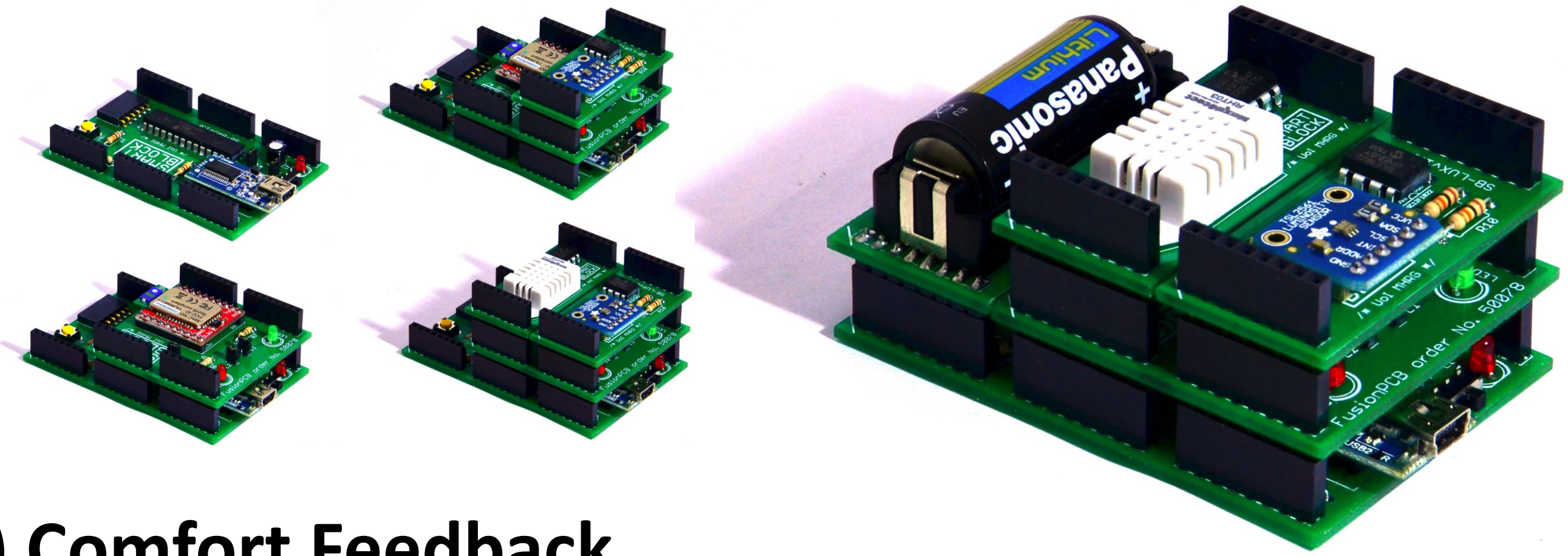
Introduction

• Building Heating Ventilation and Air Conditioning (HVAC) systems consume large amounts of energy
• Existing systems concentrate on control of the HVAC system rather than providing easy to understand information to the user.
• Existing tools for building managers are:
  o Difficult to understand
  o Information overload
  o Difficult to extract relevant information
  o Does not provide comparative energy use information
  o Does not provide suggestions for energy savings
• The internal sensors of the HVAC system does not efficiently monitor the air quality of the working areas.
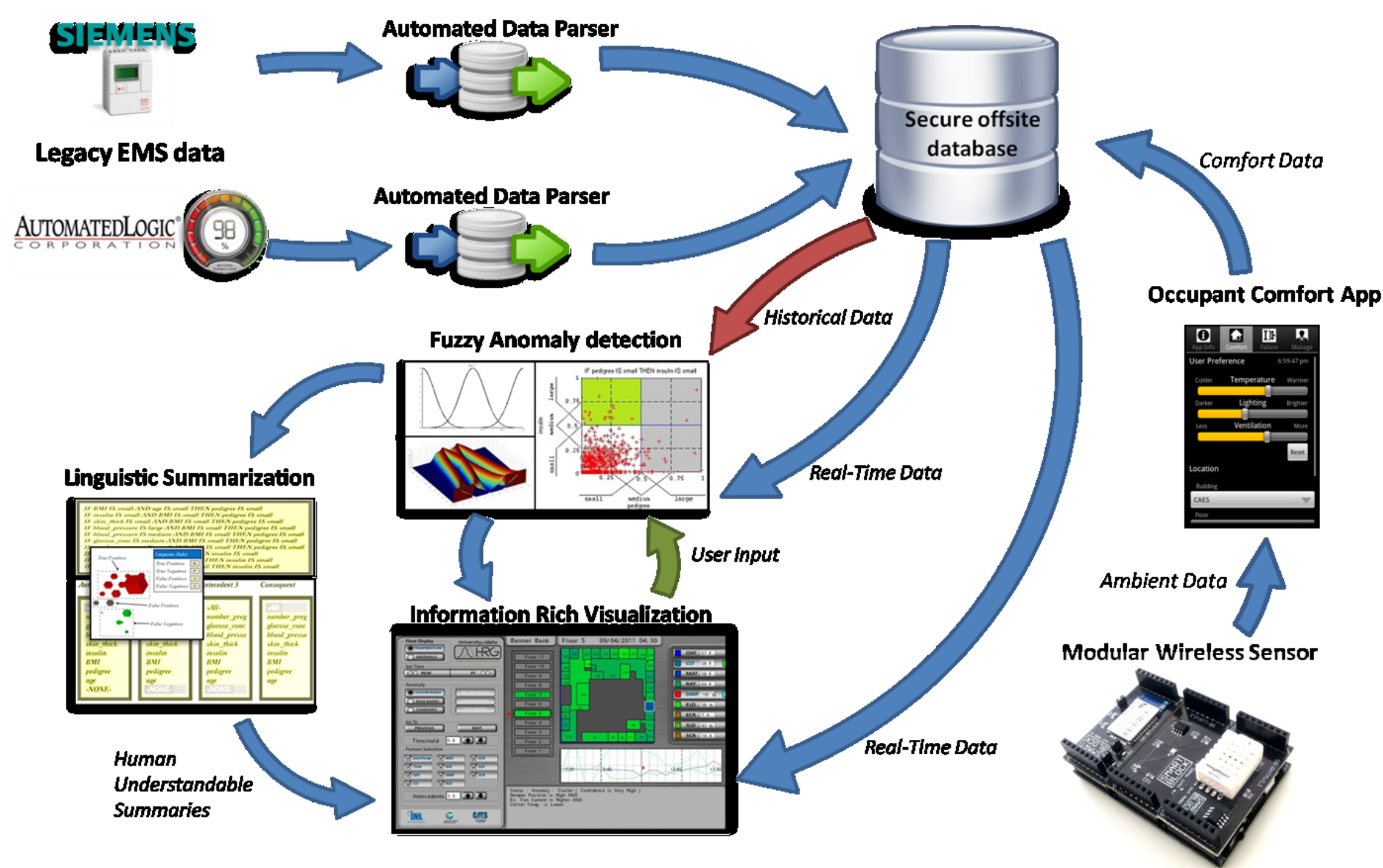• The occupant comfort is not taken into account by these systems.

Implemented Architecture

Information Retrieval

1) Wireless Sensors

• Modular design uses interchangeable modules for easy expansion
• Cost effective design
• Enables use of multiple sensors
• Small footprint
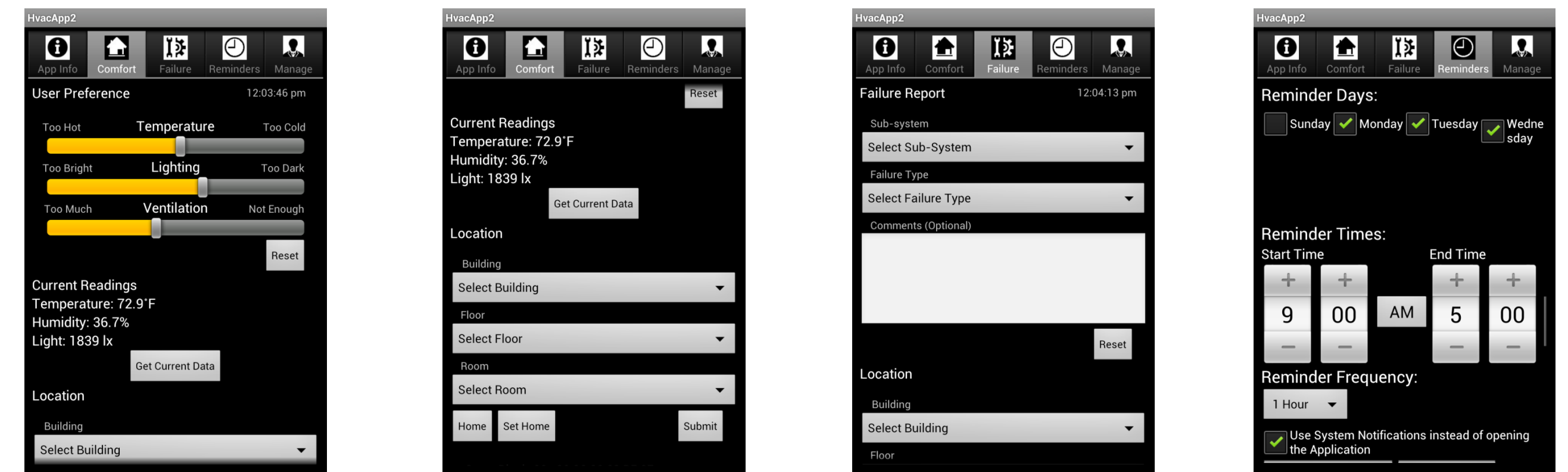• Wireless design enable easy deployment

2) Comfort Feedback

• Enables occupants to report comfort of specific locations
  o Temperature, lighting and ventilation levels
  o Specific location according to the building
• Also allows users to report system failures
• Enables building managers access comfort information instantly

Tool Development

Visualization type
Building/AHU level view
Temperature zones
Anomaly indicator
Floor level view
Building / Floor level Data
Time Selection
Anomaly Type
Anomaly Selection
Dimensionality of Anomalies

Linguistic summary of selected anomalies
Data Trends

• The tool utilizes an improved nearest neighbor clustering algorithm to cluster normal behavior.
• Clusters are used to derive fuzzy rules for normal behavior.
• Identified anomalies are summarized linguistically for increased understanding.
• Enables detecting anomalies in large sets of data easily.
• Provides functionality for report generation.

Windows Based Version:
• Optimized on Windows
• Uses OpenGL

Web Based Version:
• Can run on any web interface
• Cross-platform

Future Work

• Using Computational intelligence techniques to mine data more effectively
• Provide a multi-tier interface that enable building managers to easily access available data
• Intelligent anomaly detection based on energy usage

• Using predictive modeling to identify anomalies as they happen
• Couple EMS data with user comfort data to increase state awareness
• Generate rule bases for different type of building behavior
• Incorporate preset energy efficiency and comfort related report generation schemes