Capstone

Project Description

Project 1: Co-optimize buildings and assets using AI/ML/OR to increase Energy and Operational Efficiencies

Title: Co-optimize buildings and assets using AI/ML/OR to increase Energy and Operational Efficiencies	
willow Willow: The new way to manage buildings	OP Ravi, Director of Product, Energy Transformation opravi@willowinc.com

Project Overview:

In the US, buildings consume 76% of all electricity and account for 40% of total CO2e emissions[1]. According to the UN's Global Status Report for Buildings and Construction, the buildings sector is not on track to achieve decarbonization by 2050, with the gap between actual climate performance and the decarbonization pathway continuing to widen.

We are committed to building a sustainable future, creating environments that adapt in real time to economic, ecological, and operational demands. To achieve this, we aim to develop a technical solution using advanced technologies such as Artificial Intelligence (AI), Machine Learning (ML), and Optimization. The solution will identify the most optimal spaces and assets across hundreds of thousands of facilities and assets, maximizing the efficiency, cost savings ($) and emissions reduction (CO2e) while minimizing impacts on comfort, cost, and operational goals.

Willow is the leading AI-driven platform revolutionizing the built world. Leveraging cutting-edge digital twin technology, static, spatial and live data. Willow empowers organizations to reduce operational costs of buildings, improve sustainability outcomes and dynamically optimize asset performance at scale. Willow is changing the way the world manages buildings for a more sustainable future by enabling every building to respond to the people, purpose and environments they serve. Trusted by global leaders in education, healthcare, retail, transportation and commercial real estate, Willow is redefining how the world manages and interacts with the built environment. Visit www.willowinc.com to learn more.

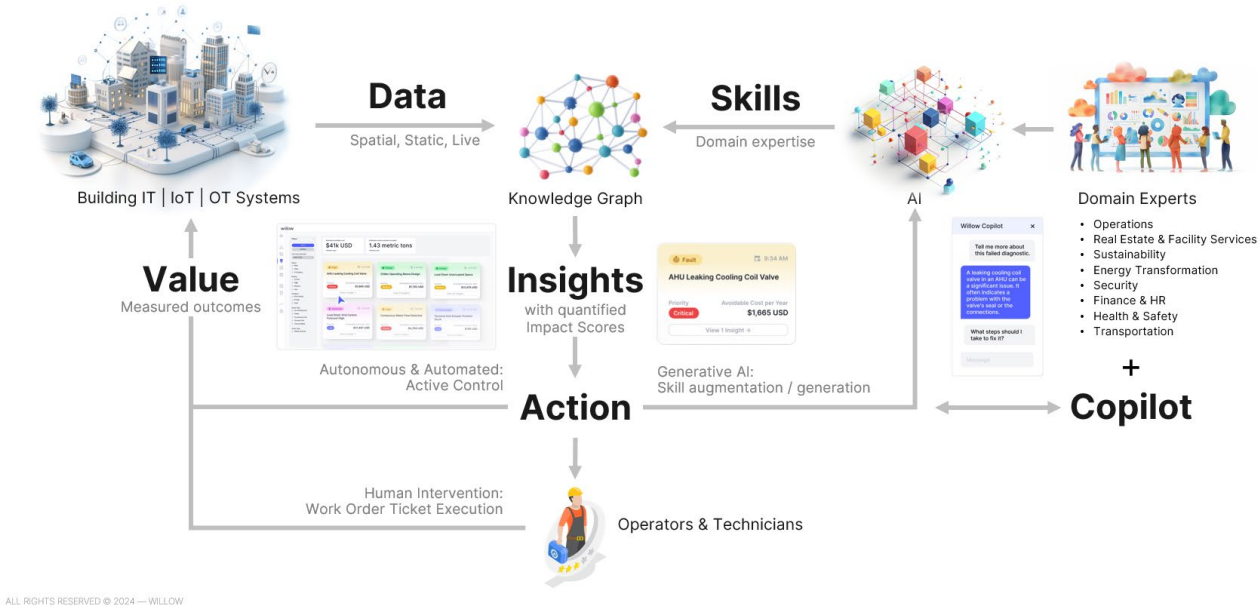
Optimization is a standard problem-solving technique to maximize or minimize the required goal within the given constraints. For example, we want to minimize the energy consumption overall North Campus without impacting the comfort and other operational goals. The challenge is the North Campus has 75 buildings and hundreds of equipment and systems like HVAC units and lighting control. The hypothesis is that the optimization model will help us to shed or shift the load optimally within all defined constraints. For examples, if we have 100 equipment available with their attributes (limits, current settings, configuration) then our solution will help us to identify optimal assets to achieve our goal. Here are a few customers scenarios

- Optimize battery charge and discharge schedule
- Optimize the usage of local solar generation when grid conditions are not favorable.
- Optimize EV charge and discharge schedule
- Optimize the building load to identify available flexibility (energy and schedule)

[1] Chapter 5: Increasing Efficiency of Building Systems and Technologies (energy.gov)

During the project scoping and feasibility phases, we will analyze and finalize the scenarios for the first MVP release.

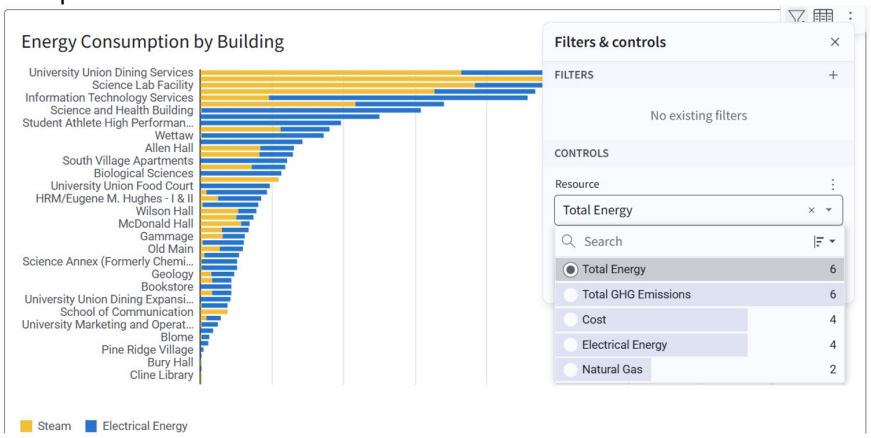
Here is current data flow and various components of Willow solution



The successful completion of the project will have multiple impacts, including:

- **Enhanced Visibility & Awareness**: Improve understanding of energy consumption patterns.
- **Lower Energy Costs**: Achieve significant savings on energy bills during event days and peak hours.
- **GHG/CO2e Reduction**: Support climate goals by increasing the use of carbon-free energy.
- **Improved Energy Resilience**: Enhance energy independence through optimized load management, local generation, and storage.

The impact report can be added as a dashboard to the NAU-Willow environment.



Knowledge, skills, and expertise required for this project:

- Willow platform (documentation and training will be provided)
- AI/ML/OR (it depends on the finalized scope)
- Knowledge and awareness of Building Management System (BMS), Energy and Emissions
- Database concepts and technologies: graph database, time-series,
- Programming skills in C#, REST API is useful

- Awareness of Azure (Microsoft Cloud services) would be helpful

Equipment Requirements:

- A work laptop/system
- There should be no specific H/W or software required other than a development platform and software/tools

Software and other Deliverables:

Software and other Deliverables:

- The software application code and ML model as described above, deployed and tested successfully in a typical real-world and development environment.
- Must include a complete and clear User Manual for configuring and operating the solution.
- A strong as-built report detailing the design and implementation of the product in a complete, clear and professional manner. This document should provide a strong basis for future development of the product.
- Complete professionally documented codebase delivered both as a repository in GitHub or some other version control repository.