Advancing Real-Time Spatial Computing with SpaceBot.ai

A Paradigm Shift in Building Sustainability and Occupant Well-being

David Turner, Co-founder & CTO SpaceBot.ai

Agenda

- Introduction
- The Problem
- The SpaceBot Solution
- Case Studies
- Future Outlook
- Q&A

What is Real-Time Spatial Computing?

- **ChatGPT -** Spatial computing is the use of digital technology to interact with the environment and spaces around us. When this interaction happens in real-time, it's called Real-Time Spatial Computing.

- **Google** - Spatial computing describes digital experiences that incorporate real-world locations and objects, typically taking the form of augmented reality, mixed reality or virtual reality that references real-world places.

- **Apple** – Out next big product

A Paradigm Shift in Building Sustainability and Occupant Well-being?

Environmental Benefits

Smart energy consumption
Waste reduction
Lower carbon footprint

Occupant Health & Comfort

Indoor air quality monitoring
Real-time space utilization for social distancing
Tailored lighting and temperature

Operational Efficiency

Predictive maintenance
Automated task prioritization for operators
Streamlined space management

Data-Driven Decision-Making

Actionable intelligence for planners and administrators
Occupant feedback loops
ROI tracking and sustainability reporting

The Problem

Most Buildings are “Dumb” and Inefficient

The Built Environment accounted for 34% of energy demand and 37% of energy and process-related CO2 emissions in 2021

COP27, 2022 Global Status Report for Buildings and Construction

COVID-19 Raised Expectations and Increased Operational Complexity

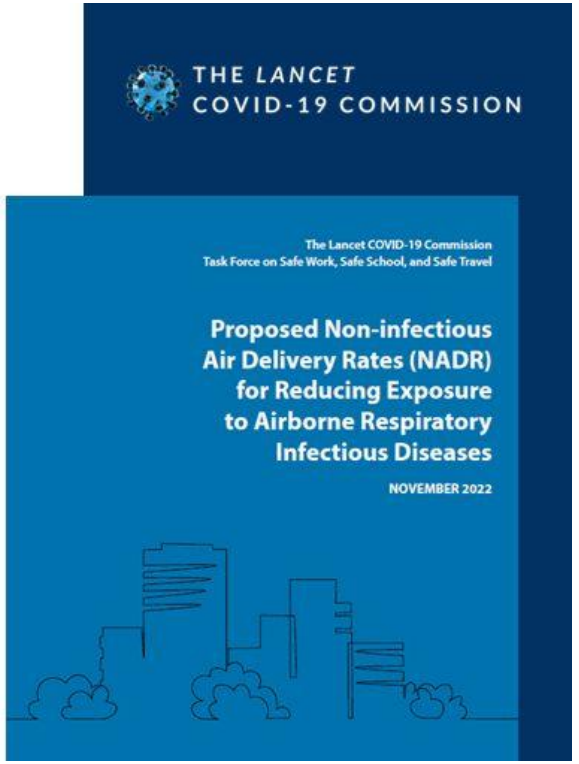
We spend roughly 90% of time indoors

Understanding the built environment unlocks unrealized efficiencies

TABLE 1.

Proposed Non-infectious Air Delivery Rates (NADR) for Reducing Exposure to Airborne Respiratory Diseases; The Lancet COVID-19 Commission Task Force on Safe School, Safe Work, and Safe Travel

	Volumetric flow rate per volume	Volumetric flow rate per person		Volumetric flow rate per floor area	
	ACHe	cfm/person	L/s/person	cfm/ft²	L/s/m²
Good	4	21	10	0.75 + ASHRAE minimum outdoor air ventilation	3.8 + ASHRAE minimum outdoor air ventilation
Better	6	30	14	1.0 + ASHRAE minimum outdoor air ventilation	5.1 + ASHRAE minimum outdoor air ventilation
Best	>6	>30	>14	>1.0 + ASHRAE minimum outdoor air ventilation	>5.1 + ASHRAE minimum outdoor air ventilation



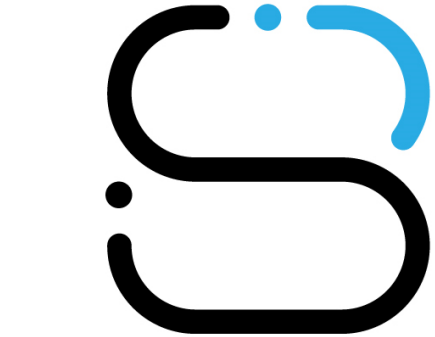
Building Management is more **Complex** and **Stressful** than ever

- CEO has pledged net-0 by 2050
- Drowning in compliance and personalization requests
- Understaffed, can’t be everywhere

Noah Emission
VP, Property & Facility Operations
BeyondBelief Systems LLC

But it doesn’t have to be …

360 visibility to inspire **confidence** in **sustainable choices**



SpaceBot

Ears, Eyes, Nose all contained in a **single box**

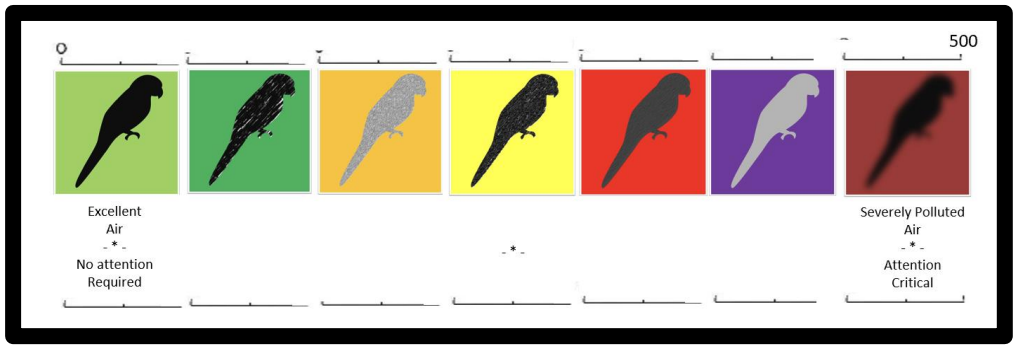
AI enhanced analytics to drive never before seen **insights**

How it Works

The Power of Awareness

Smokey Bear helped **reduce acres burned** from 22 million in 1947 to 6.6 in 2011

Meet **Larry the Canary™**



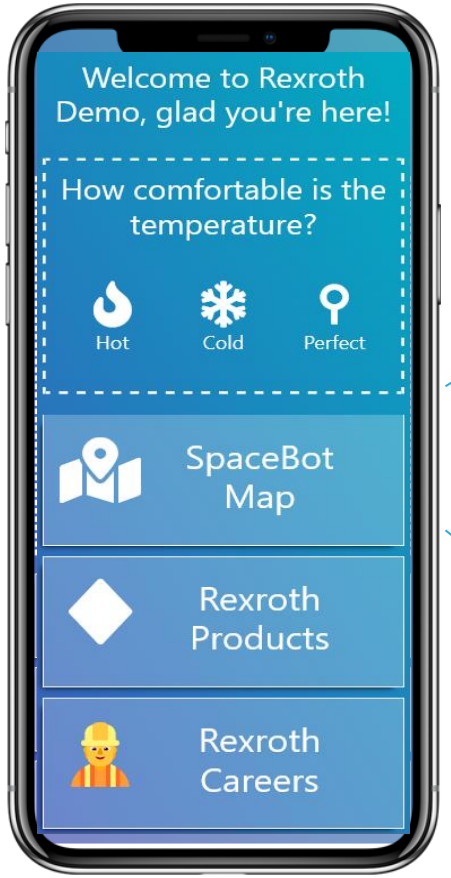
Inspires **confidence** in **sustainable** choices, operational **efficiency**, occupant **health** and **productivity**

SpaceBot’s AI-Edge Sensors Act as your Eyes, Ears, and Nose

AVAILABLE SENSOR DATA POINTS

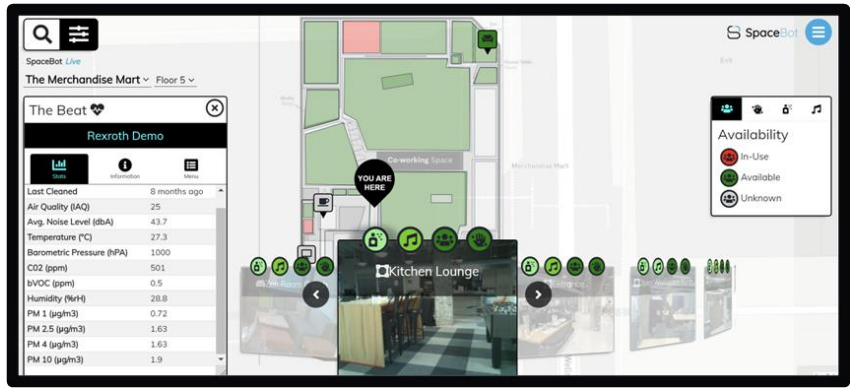
- **Machine Hearing** – Sound Events (e.g., cough, sneeze, laughter, shouting, alarms, gunshots)
- Computer Vision – **Object Detection** (e.g., person, walking aids, technology) & Utilization Heatmaps
- Indoor **Air Quality** Index (0-500)
- CO2, VOCs, Gas (% of highest level ever measured)
- Particulate Matter **PPM** 1, 2.5, 4, 10 (µg/m3)
- **Noise** Levels (dB A-weighted)
- Temperature & Humidity

QR Codes Collect User Sentiment and Provide Spatially Relevant Information and Resources.

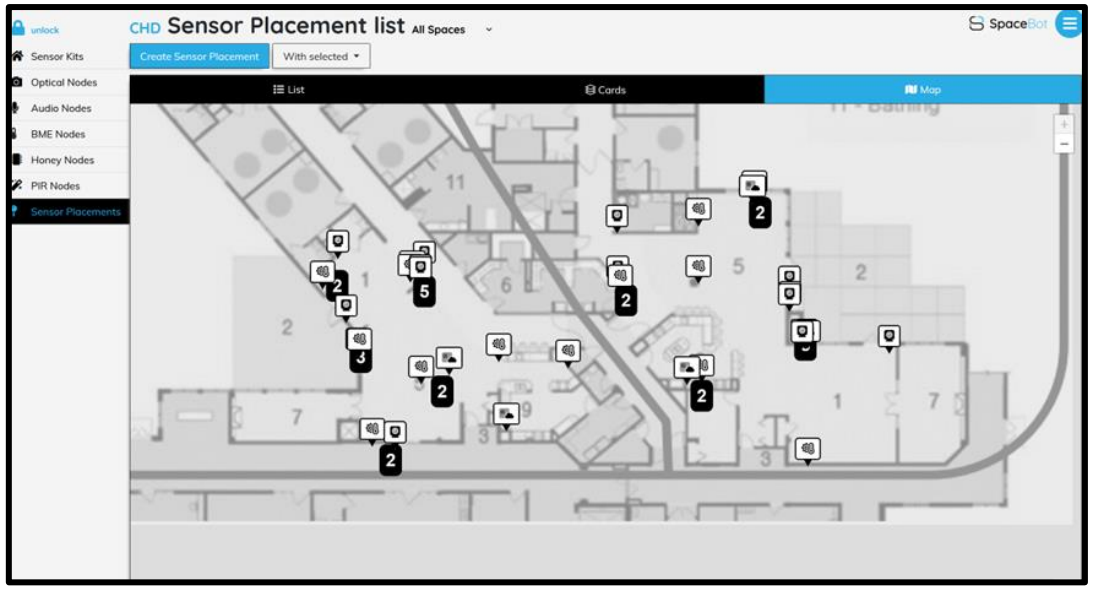


Right here right now **comfort** survey anonymously keeps Humans in the loop for better experiences

Awareness Map



Data is merged onto a **Digital Twin**



and **leveraged** for a Variety of **Use Cases**

Core Use Cases

Is the air in our building safe? How can we keep it safe?

How frequently should we clean individual spaces?

How can we improve thermal comfort while reducing our HVAC cost?

How can we encourage more in-person collaboration?

How can we get employees back to the office?

How can we reduce employee stress while increasing productivity?

Noah Emission

VP, Property & Facility Operations
BeyondBelief Systems LLC

How much space do we actually need?

What is the appropriate mix of space types?

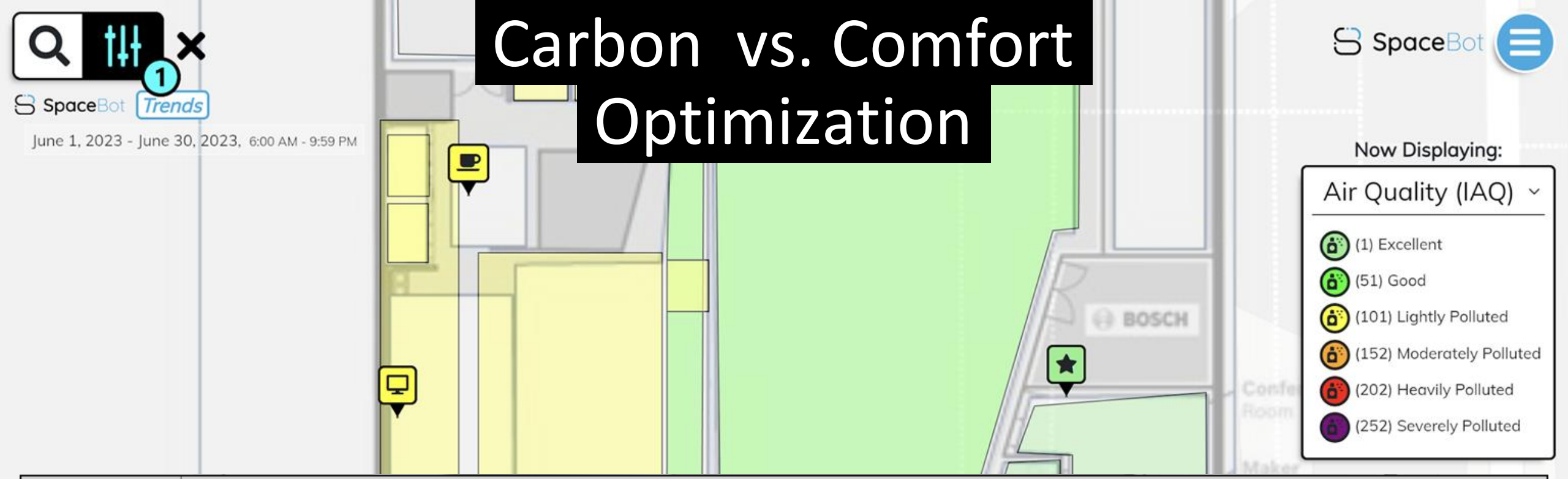
How can we better manage acoustics in this new environment of zoom calls and hybrid work?

How are individual spaces being used now?

What are the high and low performing spaces?

What environmental conditions are associated with positive and negative user experiences?

Carbon vs. Comfort Optimization



Name	Space Type	Space Tags	Utilization	Avg. Noise Level (dbA)	Air Quality (IAQ)	Climate Comfort	Technology Satisfaction
Kitchen Lounge	Area	Foosball Table < Furniture Assets	39.6%	49.24	100.26	2.4	5
Classroom	Room	Podium < Events Conference Chairs < Events Whiteboard < Furniture Assets Panasonic 70 Inch < Television	10.8%	55.6	81	4.3	4.2
Windy City Labs	Room	Prototyping Lab Soldering Iron Steels < Furniture Assets	60%	48.21	32.32	4.1	4.4

SpaceBot Janitorial Assistant

Smart Cleaning

SpaceBot

Now Displaying:

Usage Since Last Cleaned

- 100 person hours
- 80 person hours
- 60 person hours
- 40 person hours
- 20 person hours
- 0 person hours
- Unknown

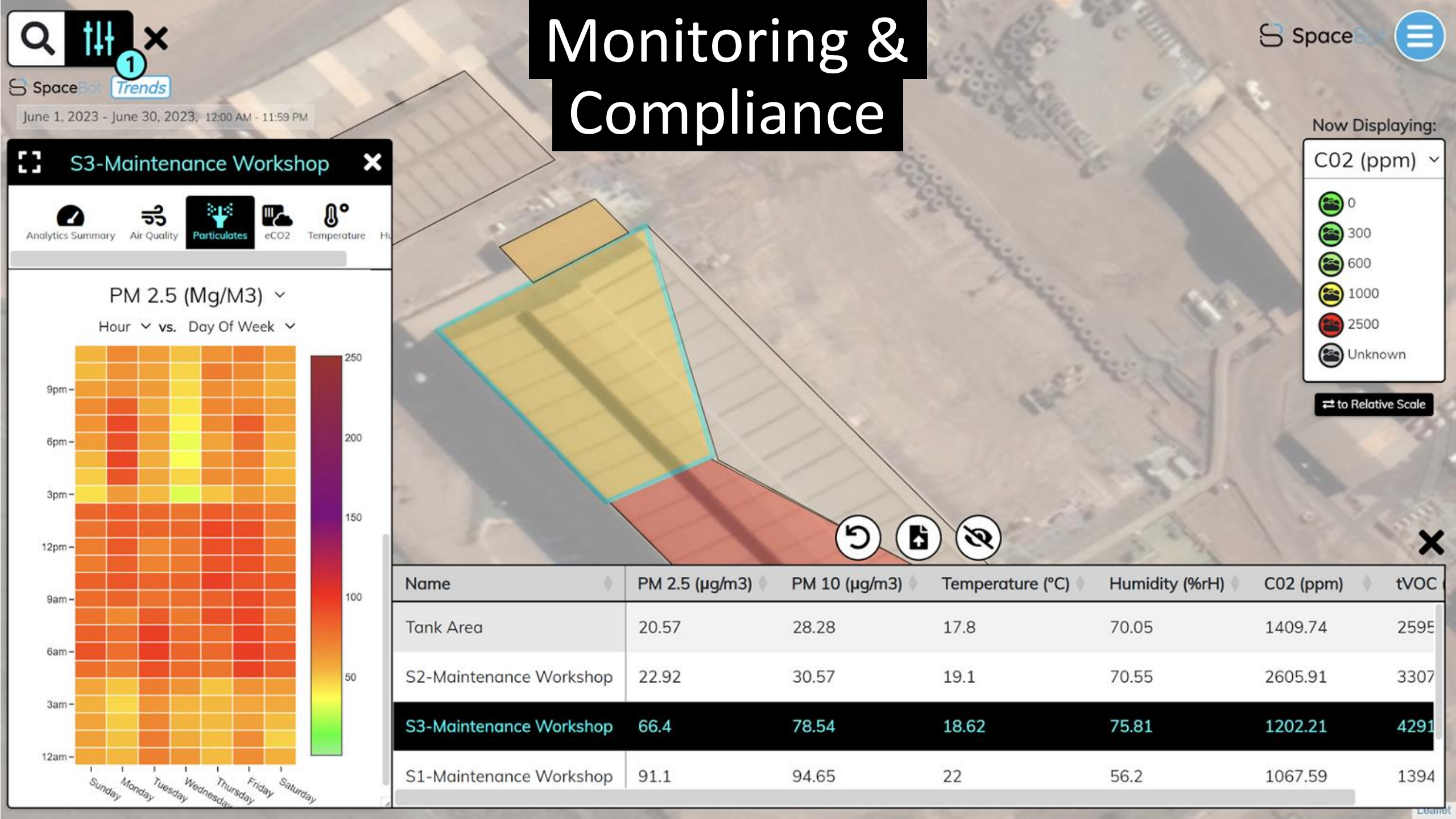
to Relative Scale

The Beat

View List

Leaflet

Monitoring & Compliance

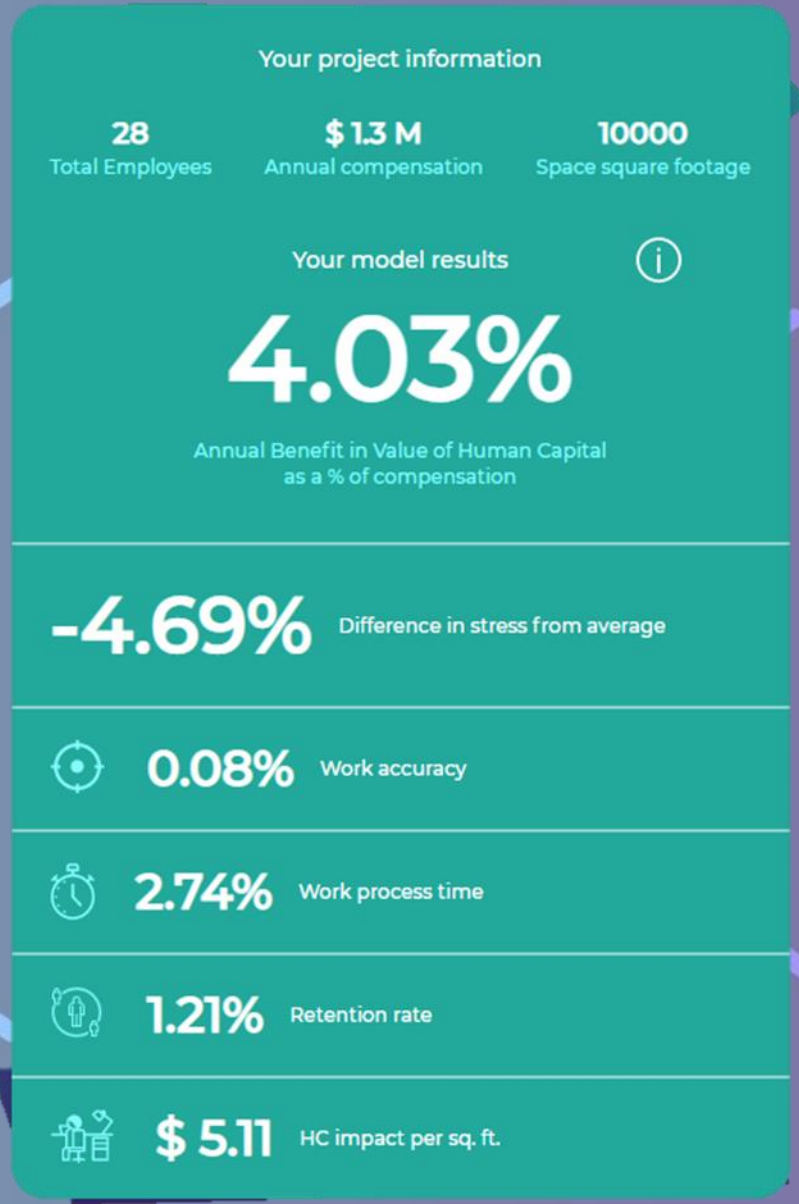


Name	PM 2.5 (µg/m3)	PM 10 (µg/m3)	Temperature (°C)	Humidity (%rH)	C02 (ppm)	tVOC
Tank Area	20.57	28.28	17.8	70.05	1409.74	2595
S2-Maintenance Workshop	22.92	30.57	19.1	70.55	2605.91	3307
S3-Maintenance Workshop	66.4	78.54	18.62	75.81	1202.21	4291
S1-Maintenance Workshop	91.1	94.65	22	56.2	1067.59	1394

Strategic Collaborations

Our Reports help you understand impact of space on retention, workforce effectiveness, stress

1. **Stress level** against benchmark
2. Impact of space on retention cost avoidance
3. Human capital value per square foot
4. Annual ROI payback of Human Capital “margin” on annual facility costs



HUMANSPACE SpaceBot

Behavioral analysis to reveal how spaces are really used

SpaceBot Trends

November 7, 2022 - November 20, 2022, 6:00 AM - 9:59 PM

Wintergarden

Analytics Summary | Behavior | Air Quality | Temperature/Humidity | Particula

Garden Spot Village

SpaceBot

Now Displaying: Utilization

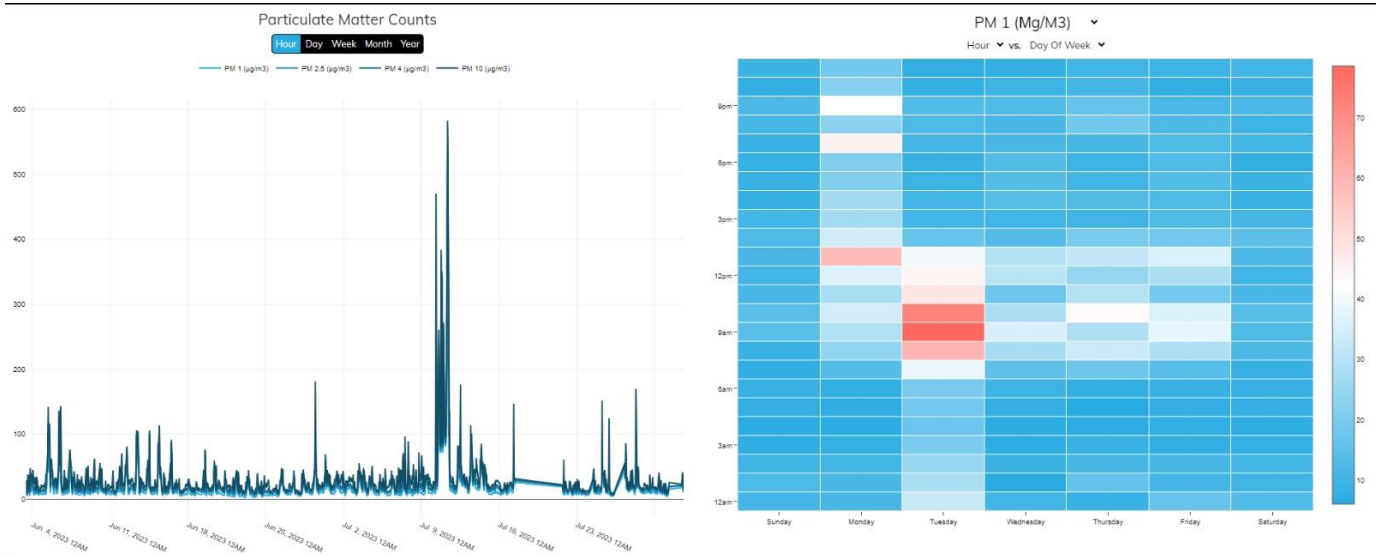
Name	Space Type	Utilization	People Count	PM 2.5 (µg/m3)	C02 (ppm)
Garden Spot Village	Building	36.2%	10.01	5.92	850.9
Wintergarden	Area	47.9%	6.78	8.11	899.87
Fallcrest	Area	24.5%	3.23	3.81	803.76
Wintergarden Dining Room	Room	39.9%	2.03	8.03	847.59

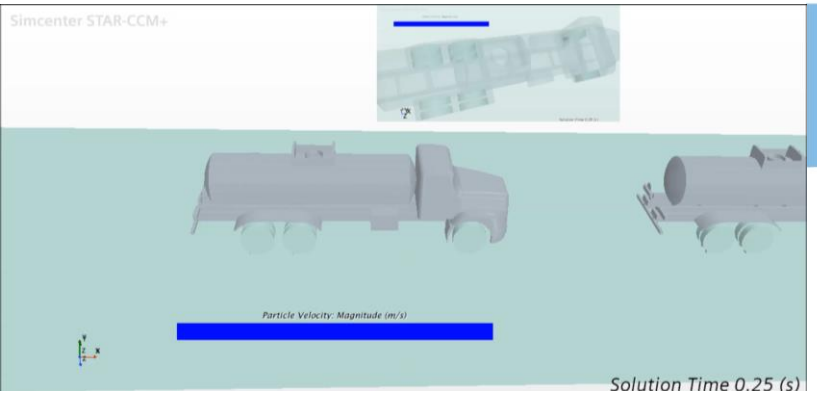
ABASTECIMENTO

Contaminação do óleo durante uso do mangote

Recomendação

- Utilizar um mangote para cada tipo de óleo;
- Fechar ambas as extremidades do mangote;
- Armazenar o mangote em local limpo;



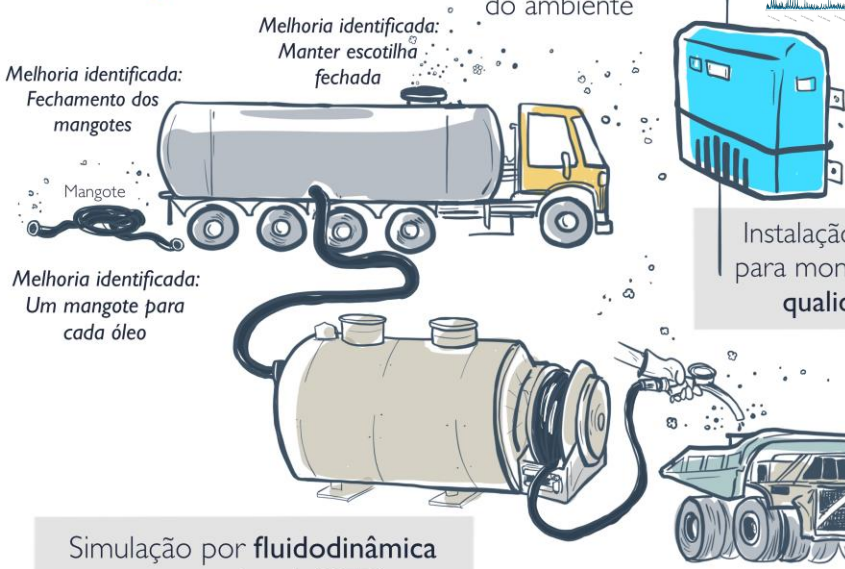


SOLUÇÃO DO DESAFIO
COMO DIMINUIR E MONITORAR A CONTAMINAÇÃO DOS ÓLEOS?

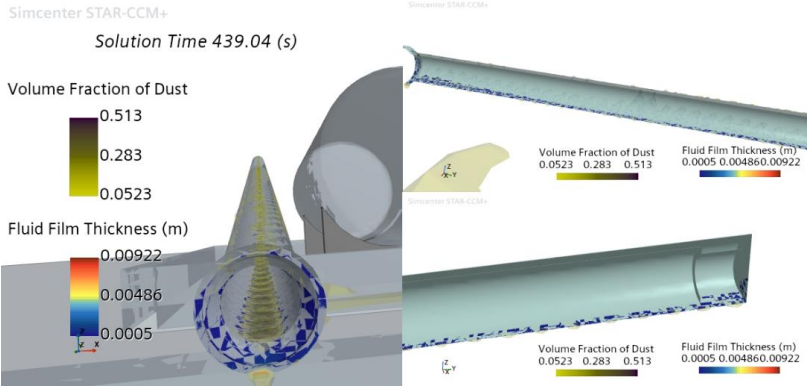
dpr ENGENHARIA E SIMULAÇÃO · VALE · FIEMG lab · IEL

SOLUÇÃO

Medição de partículas do ambiente



Instalação de **sensores** para monitoramento da **qualidade do ar**



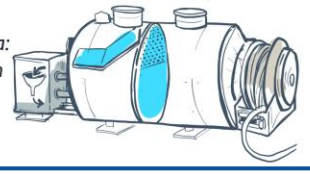
Simulação por **fluidodinâmica computacional (CFD)**

6 cenários simulados

Modelo tridimensional

Dados na nuvem

Possível melhoria: Instalação de **defletor** e **placa** de filtragem dentro do tanque



Data: 23/08/2023 00:38:21
ISO: 25 | 21 | 11

70% da contaminação observada no tanque

IMPACTOS

Redução da contaminação do óleo

Prevenção de danos e aumento da disponibilidade física dos equipamentos

Sustentabilidade (Redução de descarte = aumento de óleo regenerado)

Redução na compra de novos óleos

Future Outlook

SpaceBot

What Makes SpaceBot Different?

- **Best in-class** spatial analytics & visualization
- Sustainability + **Well-being**
- **Fit for Purpose** Sensors, Dashboards and AI
- **Forward looking** technology stack

Roadmap to Smarter Spaces

SpaceIQ

TANGO

Matterport

OFFICESPACE

Expand Markets

Integrate into built environment OS marketplace

Enter other high density property markets

Expand Use Cases

Introduce new interfaces, analytics and features

Acquire new, larger customers

Expand sensing options

dpr simulations

Foundations

Enable Connectivity, IoT Sensing Ability, Digital Twin Tooling, Analytic Engine

Early Adoption Pilots

Gensler

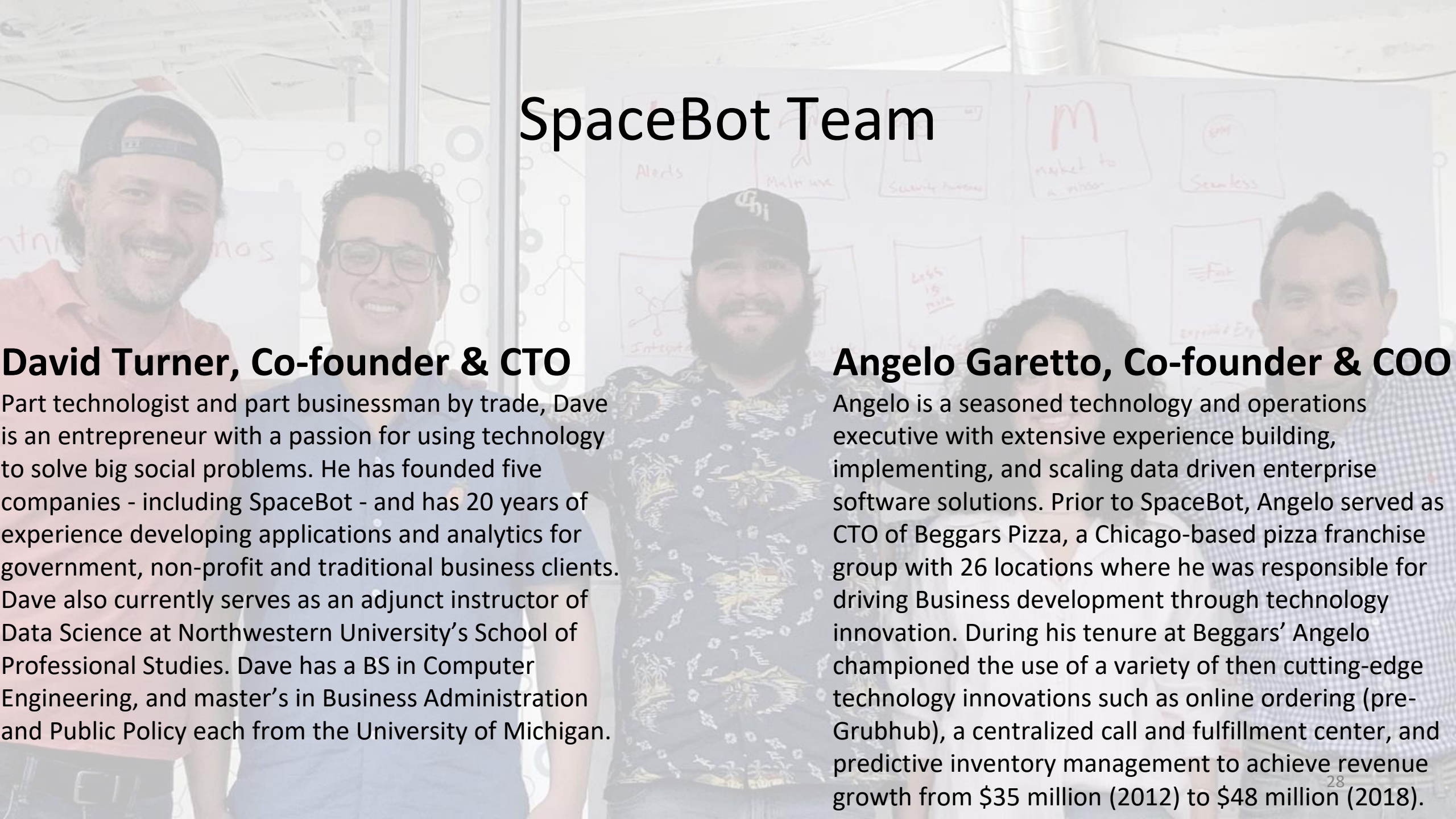
SAINT-GOBAIN

HUMANSPACE

HAWORTH

BOSCH

SpaceBot Team



David Turner, Co-founder & CTO

Part technologist and part businessman by trade, Dave is an entrepreneur with a passion for using technology to solve big social problems. He has founded five companies - including SpaceBot - and has 20 years of experience developing applications and analytics for government, non-profit and traditional business clients. Dave also currently serves as an adjunct instructor of Data Science at Northwestern University's School of Professional Studies. Dave has a BS in Computer Engineering, and master's in Business Administration and Public Policy each from the University of Michigan.

Angelo Garetto, Co-founder & COO

Angelo is a seasoned technology and operations executive with extensive experience building, implementing, and scaling data driven enterprise software solutions. Prior to SpaceBot, Angelo served as CTO of Beggars Pizza, a Chicago-based pizza franchise group with 26 locations where he was responsible for driving Business development through technology innovation. During his tenure at Beggars' Angelo championed the use of a variety of then cutting-edge technology innovations such as online ordering (pre-Grubhub), a centralized call and fulfillment center, and predictive inventory management to achieve revenue growth from $35 million (2012) to $48 million (2018).

Let’s **Create** Sustainable Better Experiences **Together!**

SpaceBot is actively seeking **new clients** and **strategic partners** to operationalize and **scale** our spatial **intelligence** capabilities.

info@spacebot.ai **OR**