CPS: Medium: Bio-socially Adaptive Control of Robotics-Augmented Building-Human Systems for Infection Prevention by Cybernation of Pathogen Transmission

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https://www.nsf.gov/awardsearch/showAward?AWD_ID=2038967&HistoricalAwards=false

Problem Statement and Critical Need

▪ Microbial pathogen transmission in buildings is an urgent public health concern. Reducing the transmission of pathogens and exposure risks in built environments is tremendously challenging due to the dynamics and complexity of the building-human-pathogen system of systems.

▪ The pandemic of COVID-19 further adds to the urgency of developing effective means to reduce pathogen transmission in public buildings with minimal disruptions in building functions.

Project Objective

▪ This project will develop smart control strategies for buildings and assistive robots to mitigate pathogen transmission and occupant exposure. New techniques will be developed to monitor and predict pathogen spreading, automate building ventilation, enable intelligent recognition of contaminated objects, and perform precision disinfection to reduce pathogen transmission through air circulation and surface contacts.
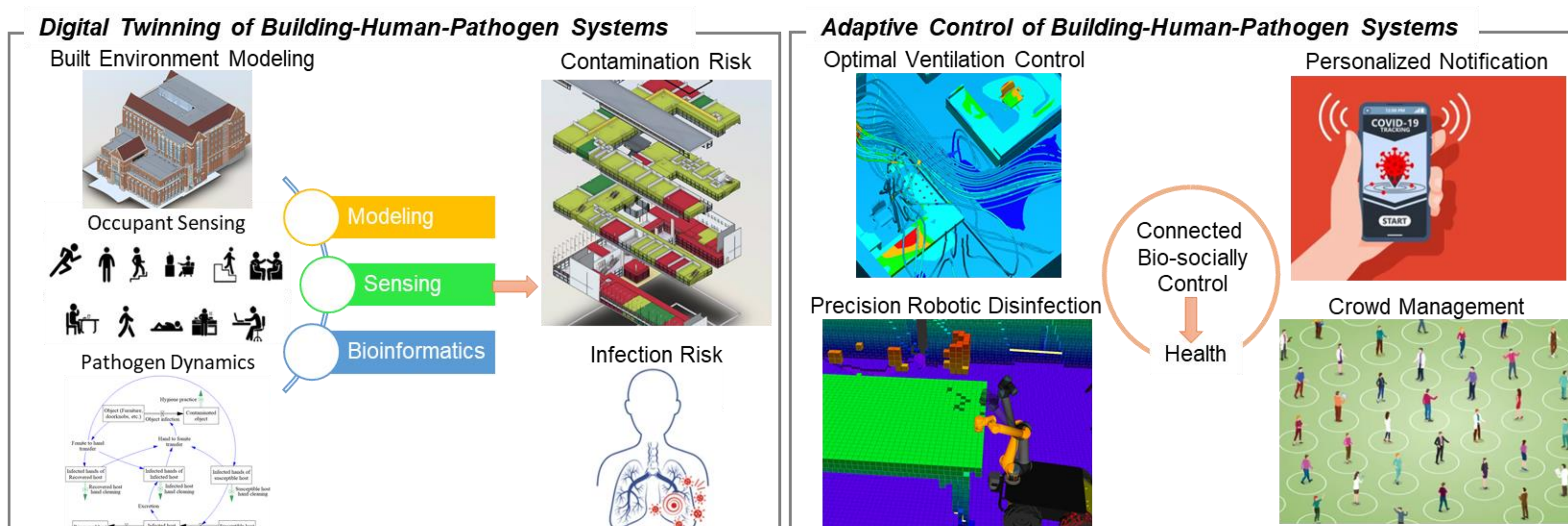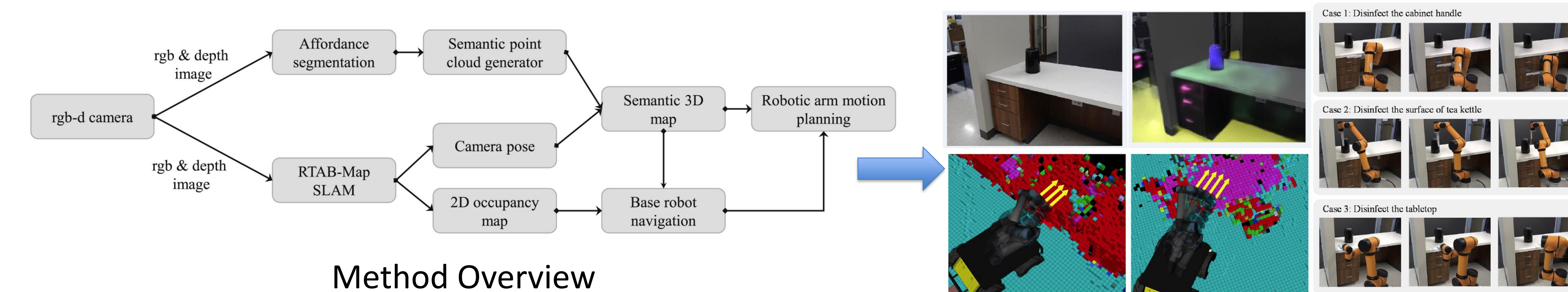

Project Update

▪ Developed a model to predict contamination and infection risks at the room level
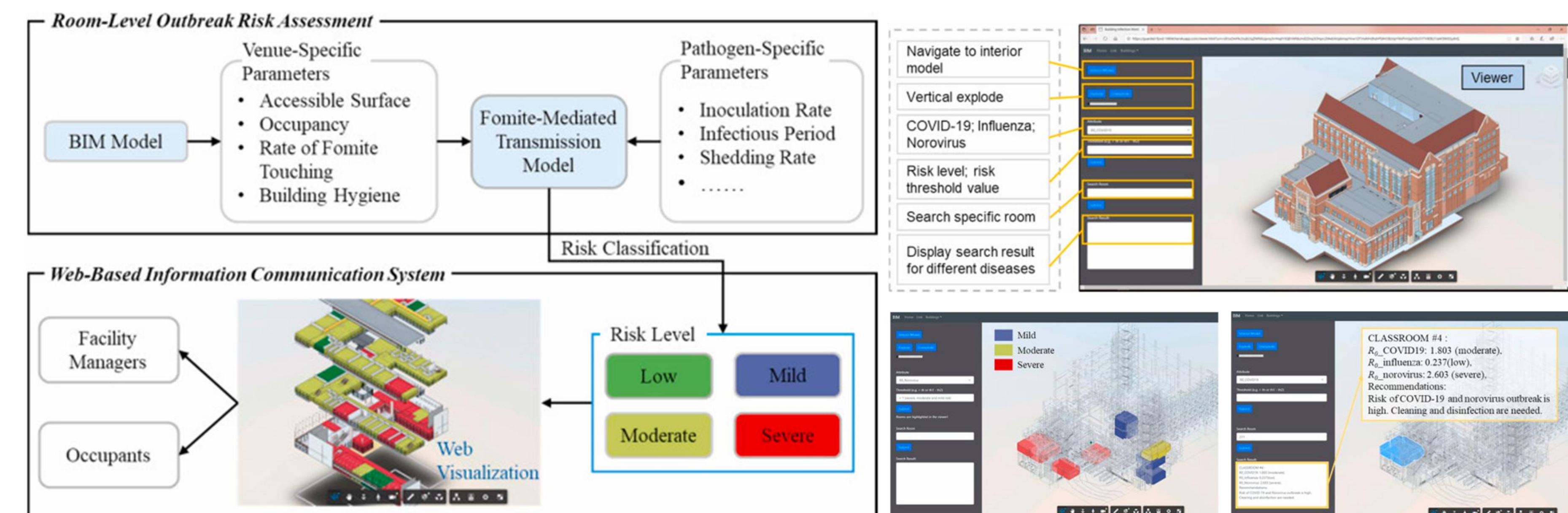
▪ Developed an intelligent and adaptive robotic disinfection method

Method Overview

Scientific and Broader Impact

▪ Pioneer a novel digital twinning approach, aided by artificial intelligence, building information modeling, internet of things sensing, and spatiotemporal microbial sampling and analysis, to model and monitor the dynamic building-human-pathogen systems.

▪ Connect and control buildings, occupants, and assistive robots in a bio-socially adaptive manner to reduce pathogen transmission.

▪ Have great potentials to reduce the exposure risks of building occupants to infectious diseases and eliminate key hotspots of community transmission, thus contributing to the national public health.