Bureau of Energy Efficiency

सत्यमेव जयते
Government of India
Ministry of Power

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ANGAN
Augmenting Nature by Green Affordable New-habitat

A Courtyard for Revolutionary Change in Building Energy Efficiency

An International Conference on Building Energy Efficiency

9th-11th September, 2019 | Hotel The LaLiT, New Delhi

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THIS PRESENTATION WAS SHARED BY

Prof. Vishal Garg

Professor, IIIT, Hyderabad

FOR THE SESSION:

" Occupant Comfort: Thermal, Visual, Acoustic, Indoor Air Quality"

DURING ANGAN 2019

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Task Control for Thermal Comfort and Demand Response

Vishal Garg

Professor and Head

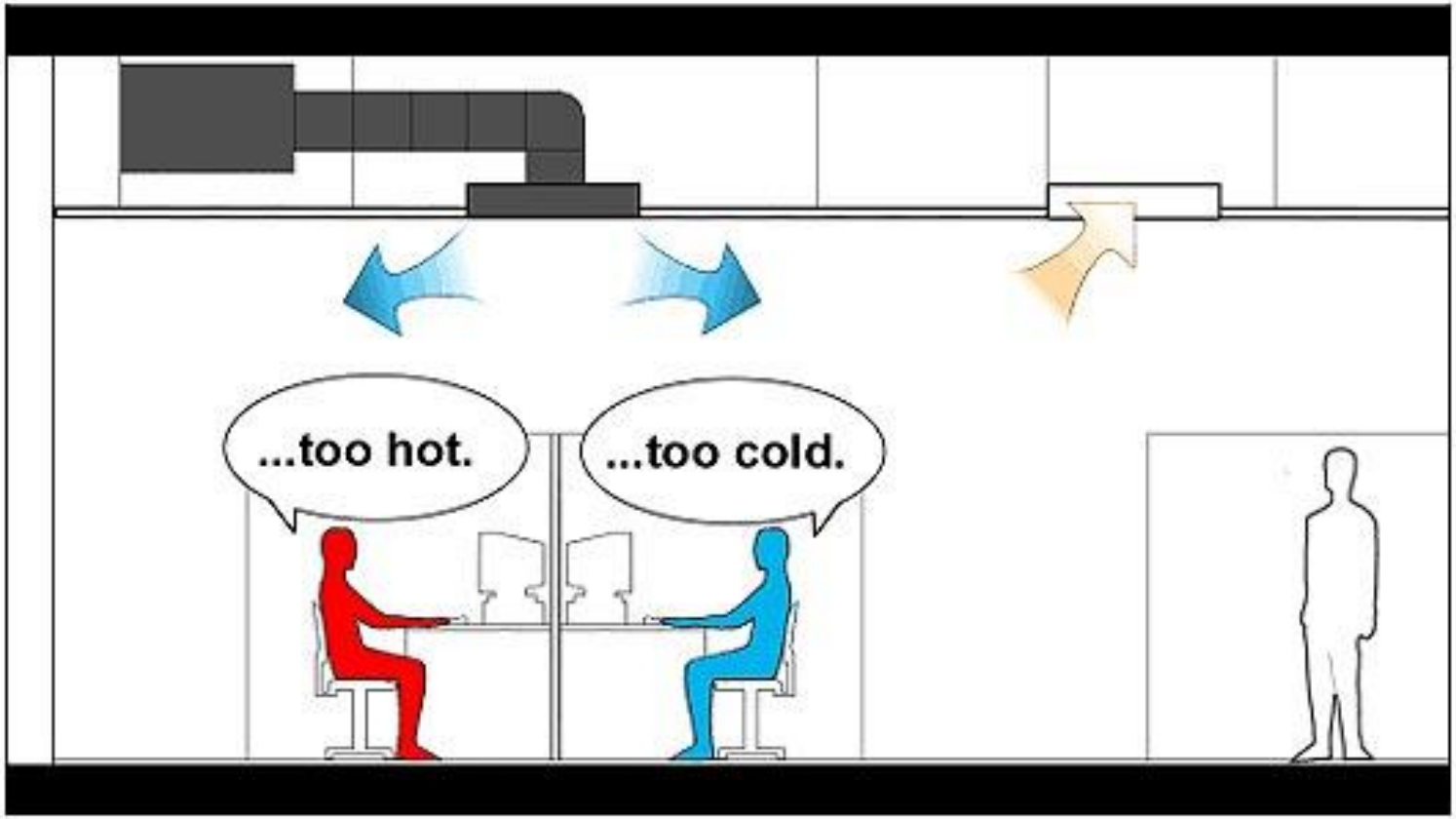
Centre for IT in Building Science

IIIT-Hyderabad

What is the individual's control over environment?

Personal Comfort

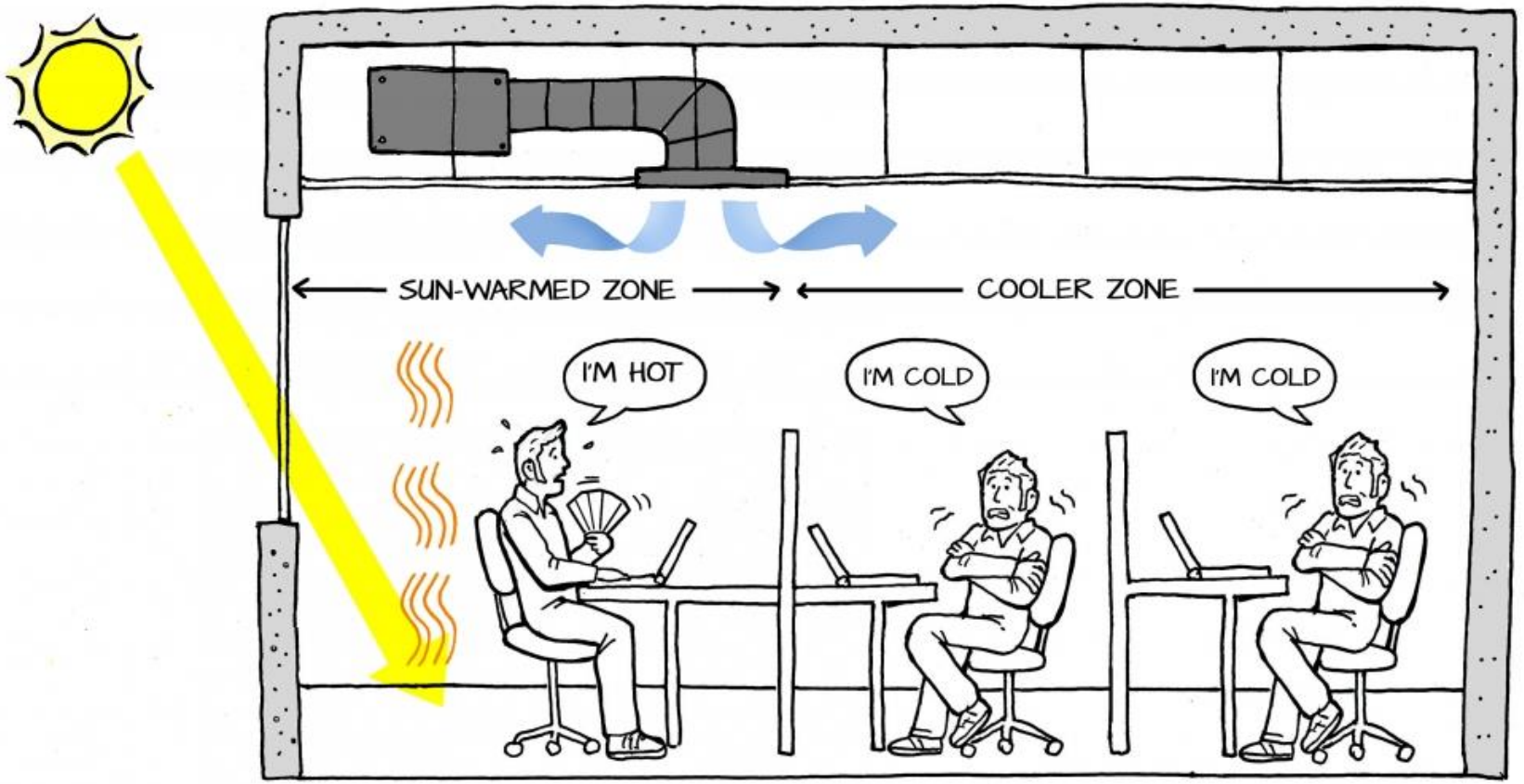
Different thermal requirements



Reference: https://www.cbe.berkeley.edu/underfloorair/thermalcomfort.htm

Personal Comfort

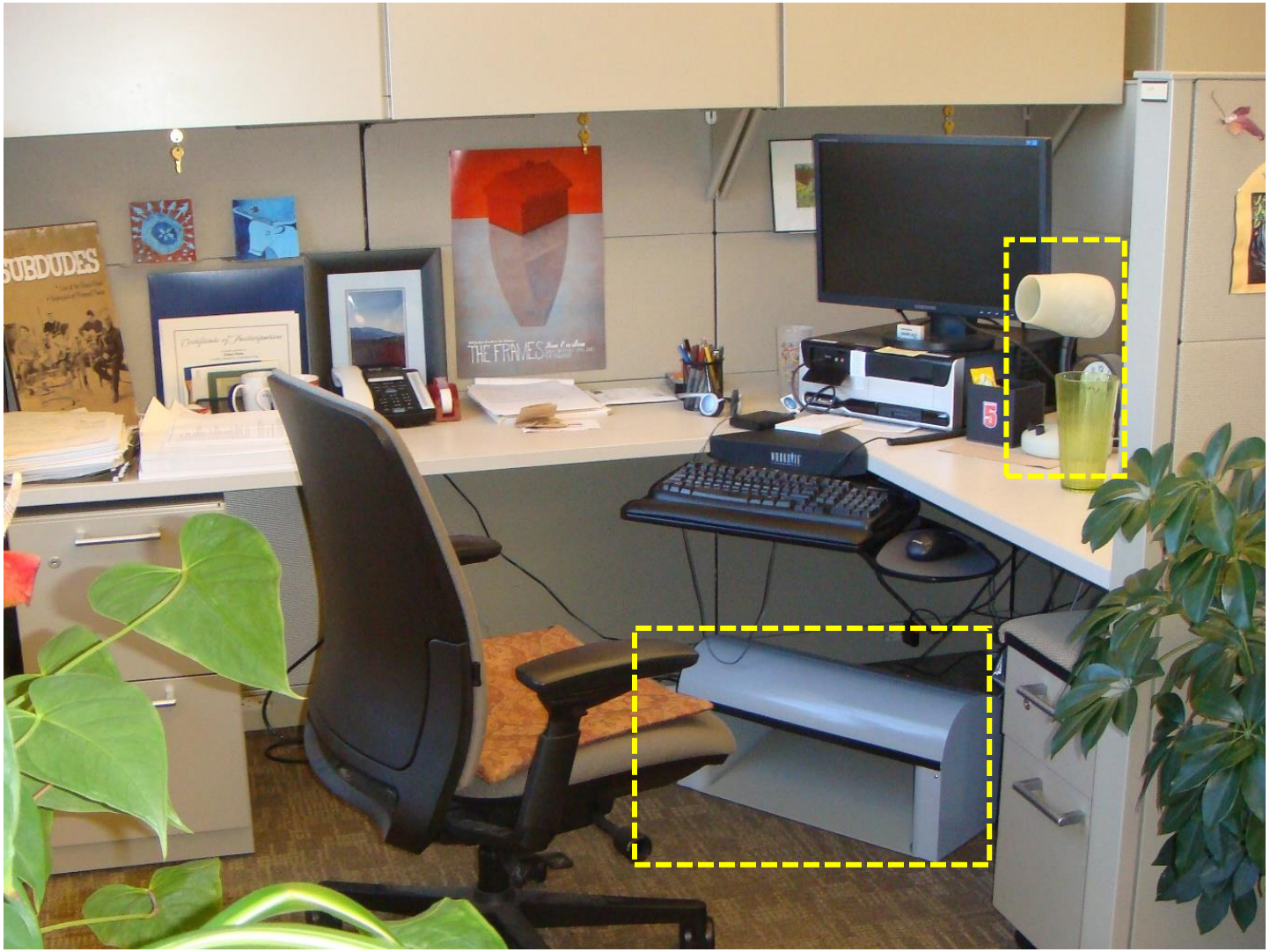
Non uniformity in spaces



Reference: https://www.cbe.berkeley.edu/underfloorair/thermalcomfort.htm

How can we deliver personalized services?

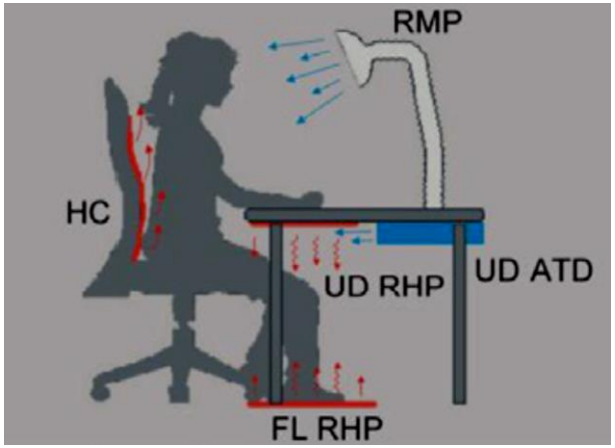
Personal Comfort Systems (PCS)



Source: www.cbe.berkeley.edu

Personal Comfort Systems (PCS)

HC – Convective heating chair
UD-RHP – underdeck radiant heating panel
FL RHP – Floor radiant heating panel



Reference: Center for the Built Environment

Benefits of PCS

- User can customize their work space leading to higher satisfaction
- Improves productivity
- Energy savings potential

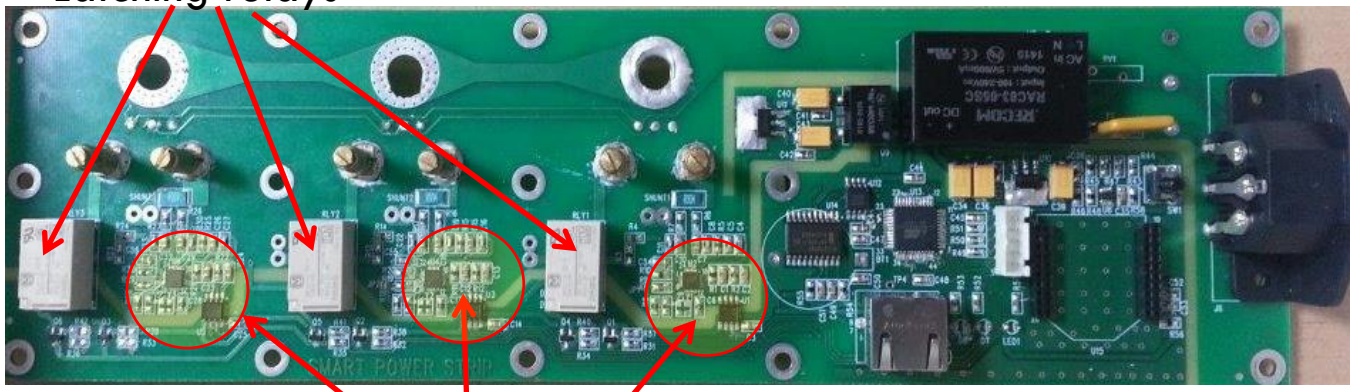
Proposed solutions

- ✓ wireless/wired low power sensors, virtual sensors
- ✓ Automatic detection of connected loads(ID tags/ML)
- ✓ Open source, industry grade, scalable transactive platform-VOLTRON
- ✓ Workstation hub to integrate all the devices
- ✓ A user interface that can do analytics & provide actionable information & intuitive higher level controls

Plug Load detection

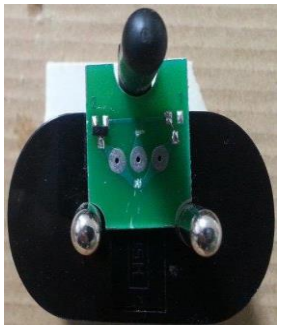
Latching relays

PCB top view

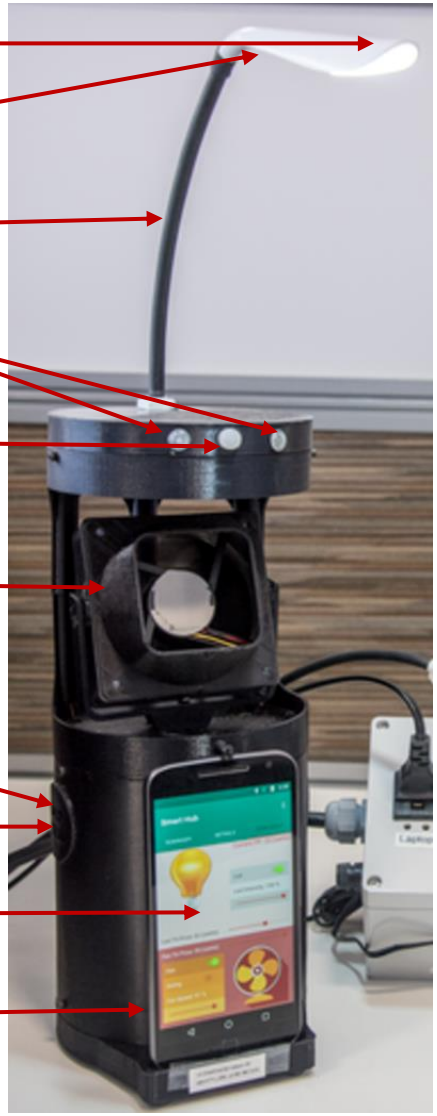


Energy metering section

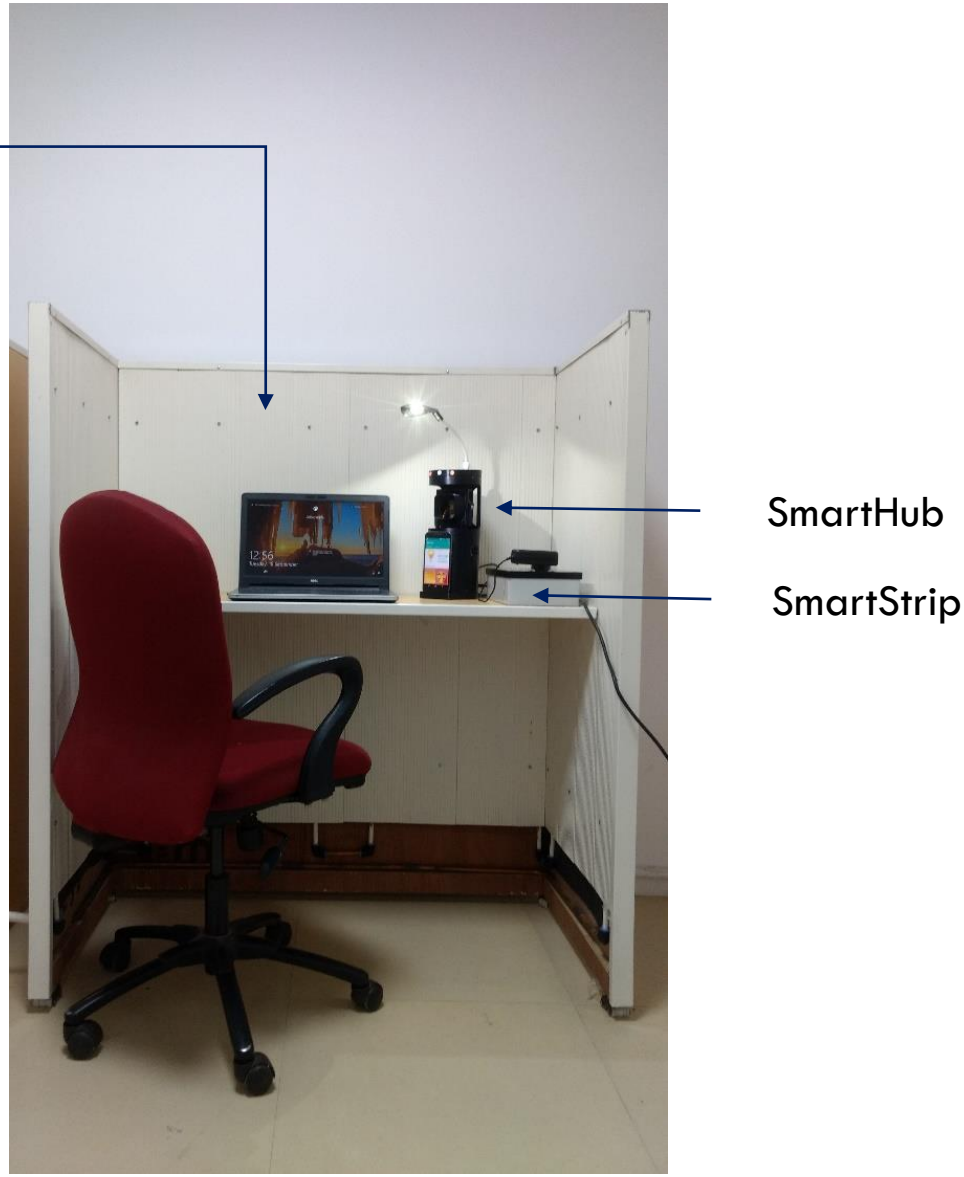
Chip on Plug



SmartHub


LED Task Light
Lux Sensor
Lamp Goose Neck
Status LEDs
PIR Sensor
Task Fan
CO2 Sensor
Temp/Rh Sensor
User Interface
Mobile Phone

Radiant Cooling Cubicle

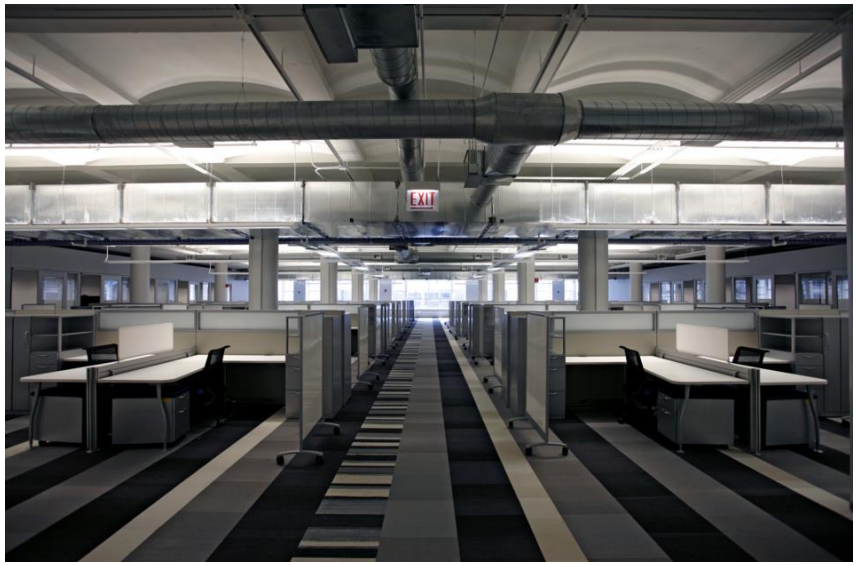


iSPACE

intelligent **S**ystem for **P**ersonalized **A**utomated **C**ontrol & Energy **E**fficiency

Solution: Managing energy consumption on an individual workspace level instead of whole building level (bottom-up). But aggregating from workstation to zone to building.

From this



Conditioning of a whole building

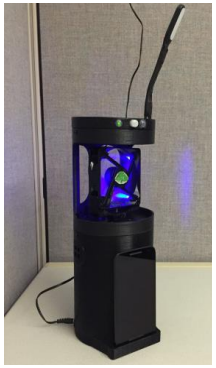
To this

Smart Plug Strip

iSPACE

VOLTTRON™
Devices | Data | Decisions

Transactive Software

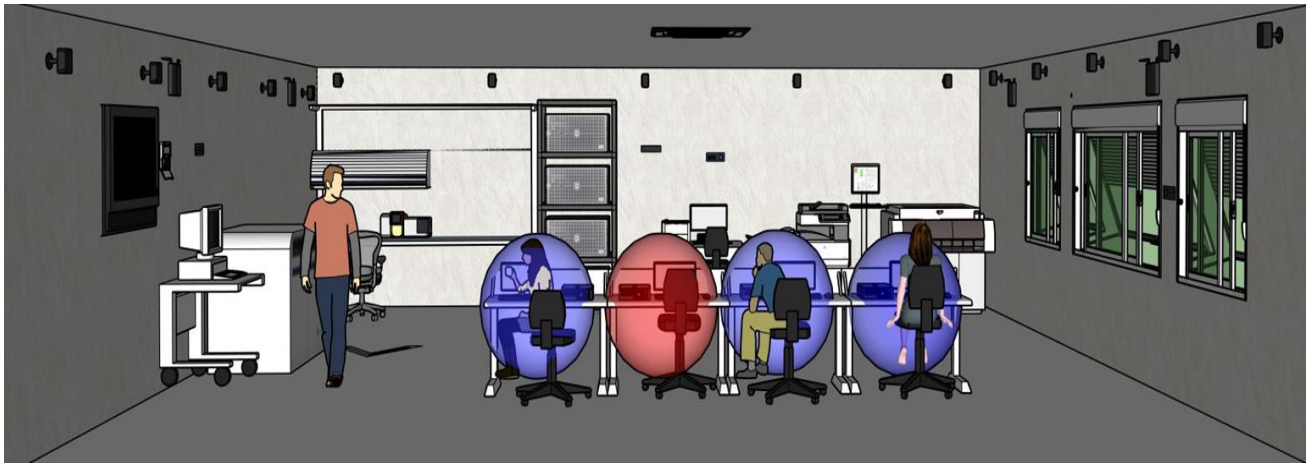


Smart Hub with fans, light and sensing

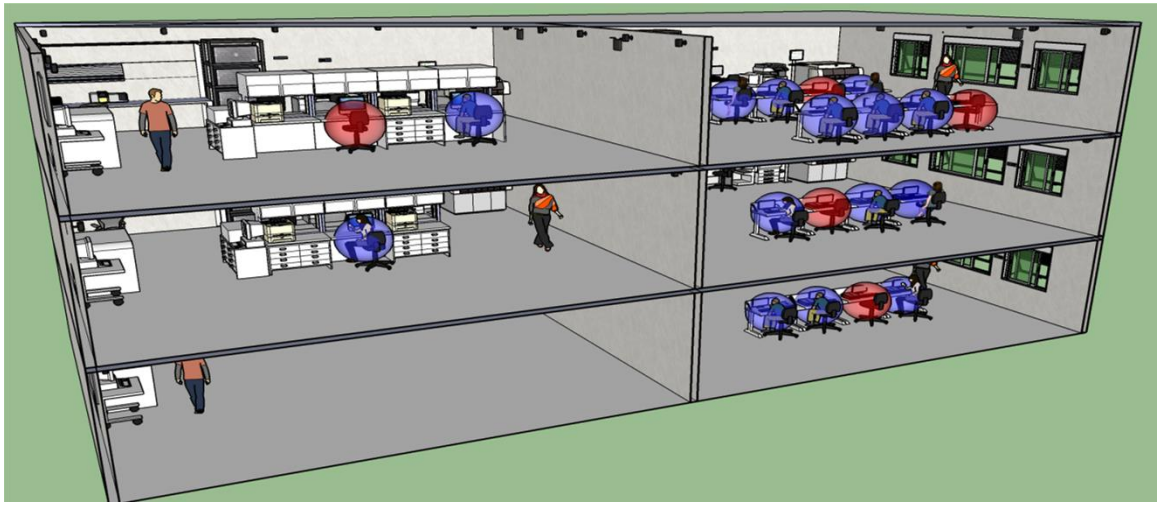
Hyperlocal workstation comfort conditioning and plug loads control

iSPACE

intelligent System for Personalized Automated Control & Energy Efficiency



Workstation	Zone
Networked plugstrip	Shades
Personalized fan / radiant cooling/ heating	Zone HVAC
Task light	Ambient light
Battery storage	Battery



iSPACE

intelligent System for Personalized Automated Control & Energy Efficiency

CBERD Project - iSPACE: Intelligent System for Personalized Automated Controls and Energy Efficiency: An Intelligent Workstation/Zone Building Control System for Integrated Environmental Comfort, Energy and Load Management Based on Localized Energy Prices (Patent pending for India and US)

Comfort

Well being

Productivity

✓

Energy Efficiency

✓

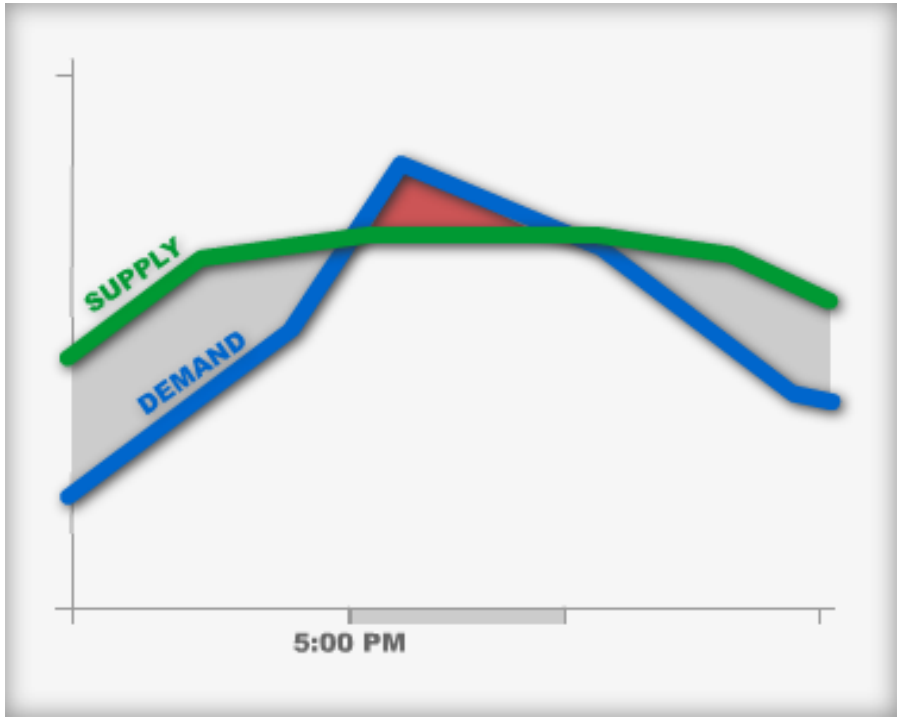
Demand Response

?

Demand Response

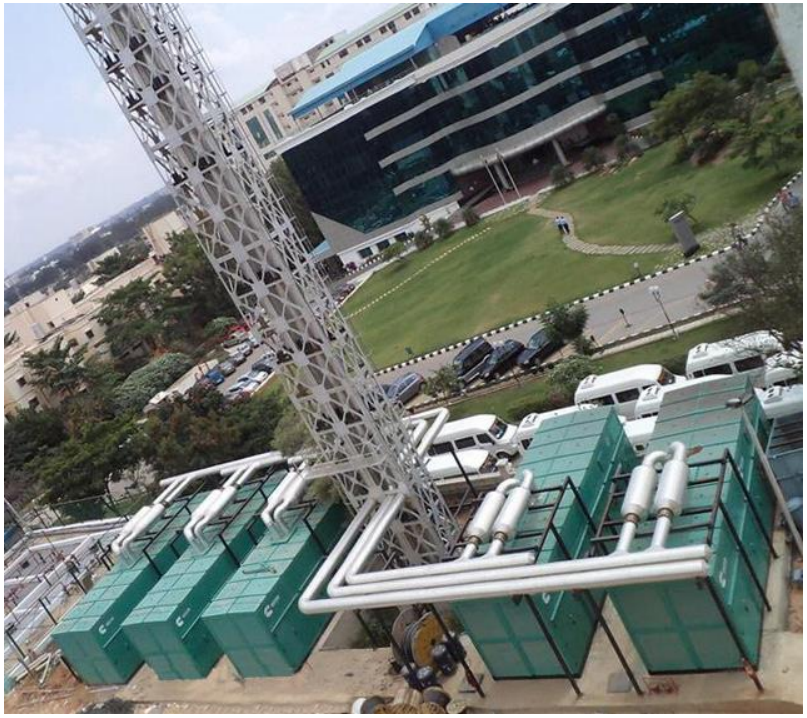
Two scenarios

No limit on power supply, cost vary



US: Peakers can provide energy at high cost

Limit on load, fixed cost



India: 5x1.5MW backup generators at office complex for grid outages

(source: Powerica)

How can transactive controls help?

iSPACE - Transactive Energy(TE)

"A set of economic and control mechanisms that allows the dynamic balance of supply and demand across the entire electrical infrastructure using value as a key operational parameter." – **GridWise Architecture Council**

iSPACE - TE

Scenario 2, case where hard limit on power (budgets)

iSPACE - TE

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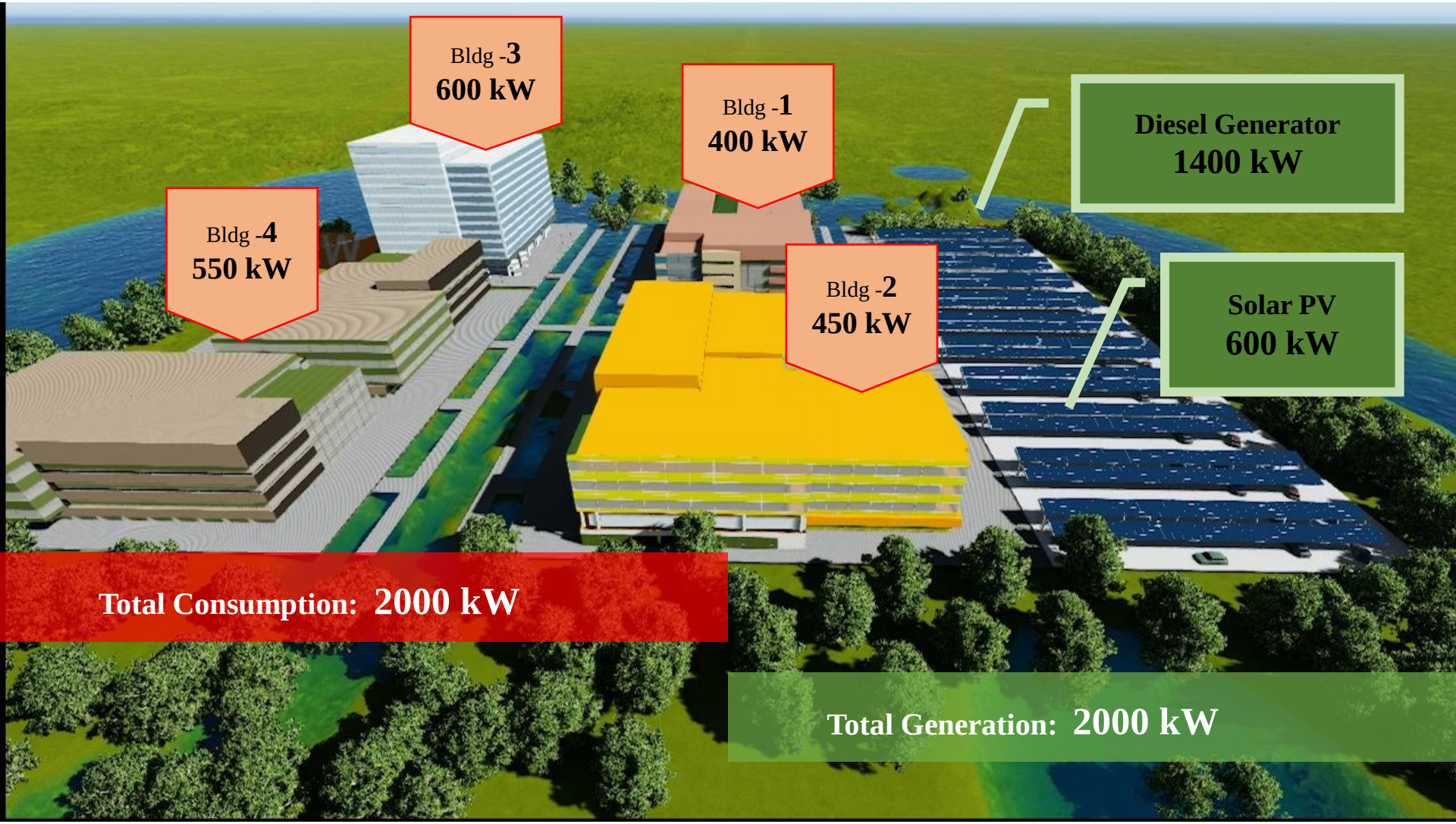

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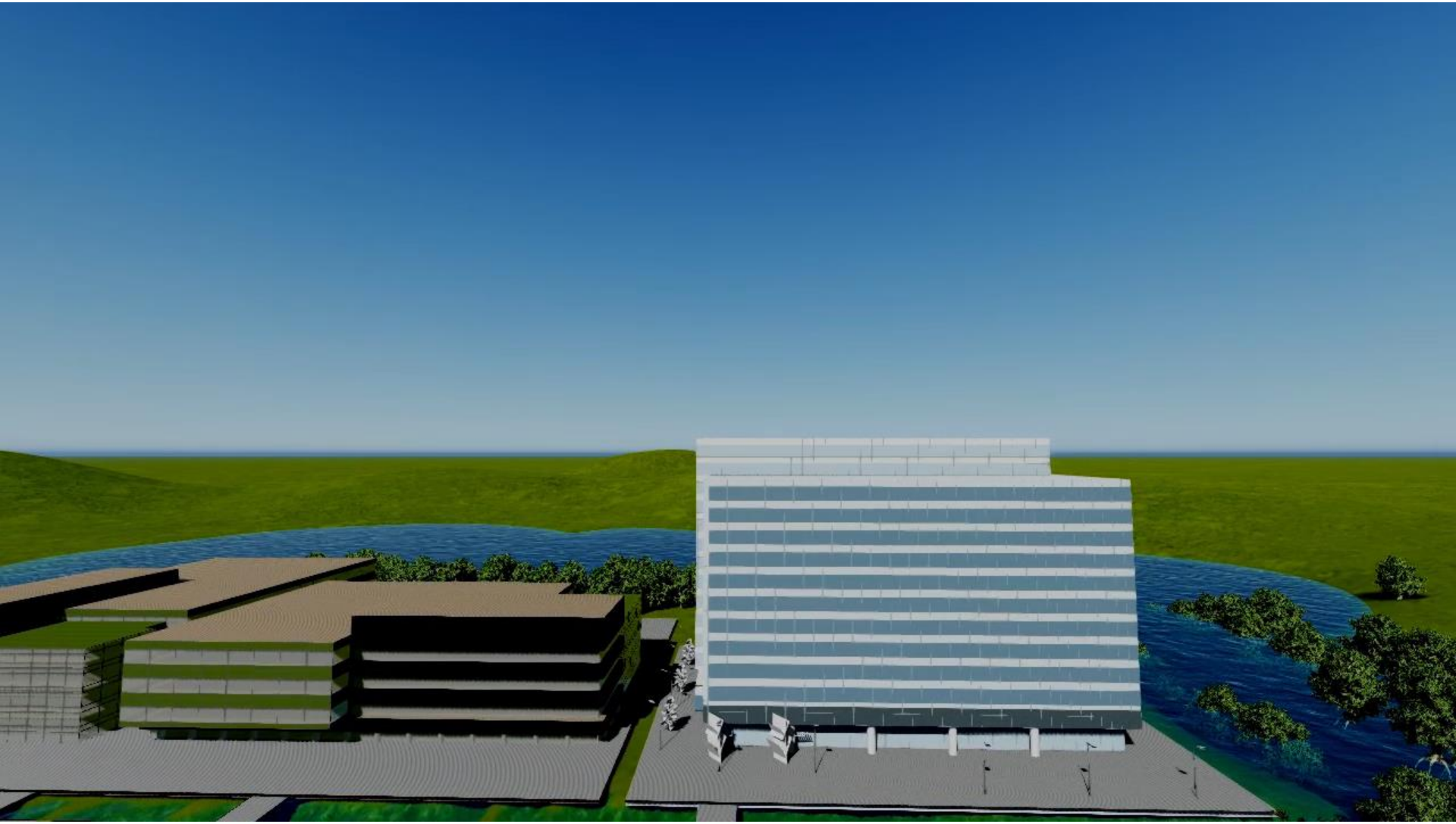

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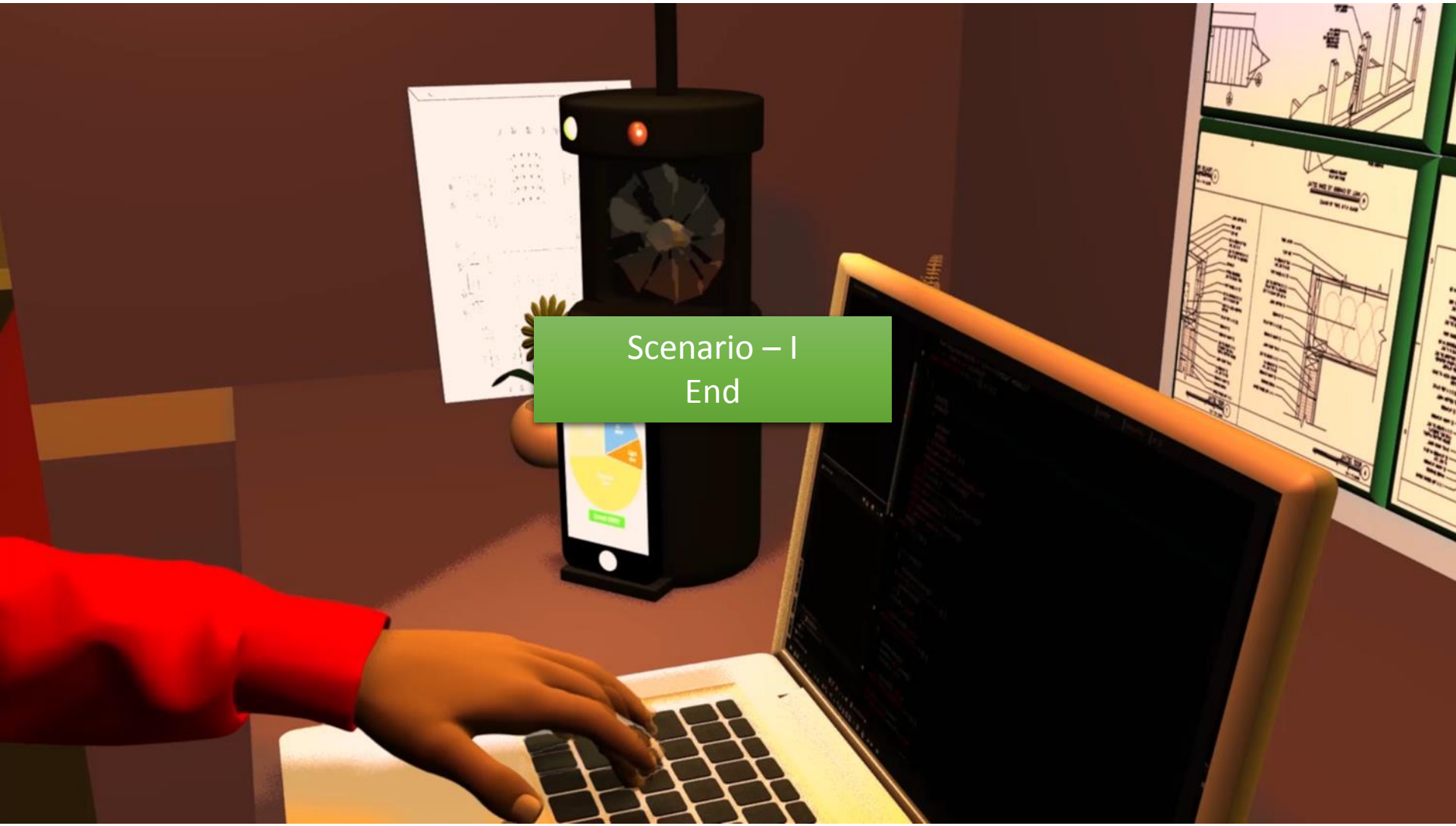

iSPACE - TE

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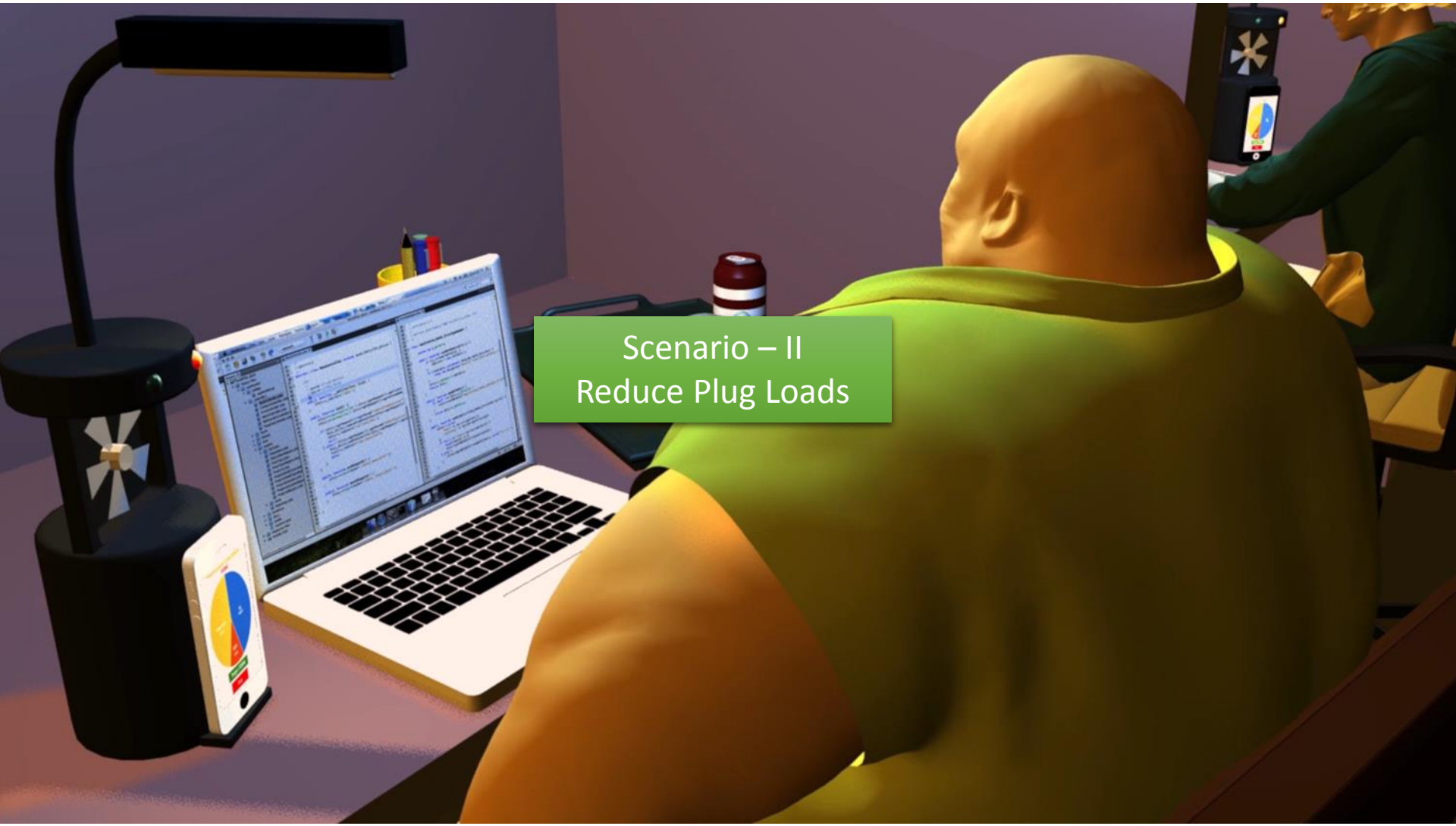

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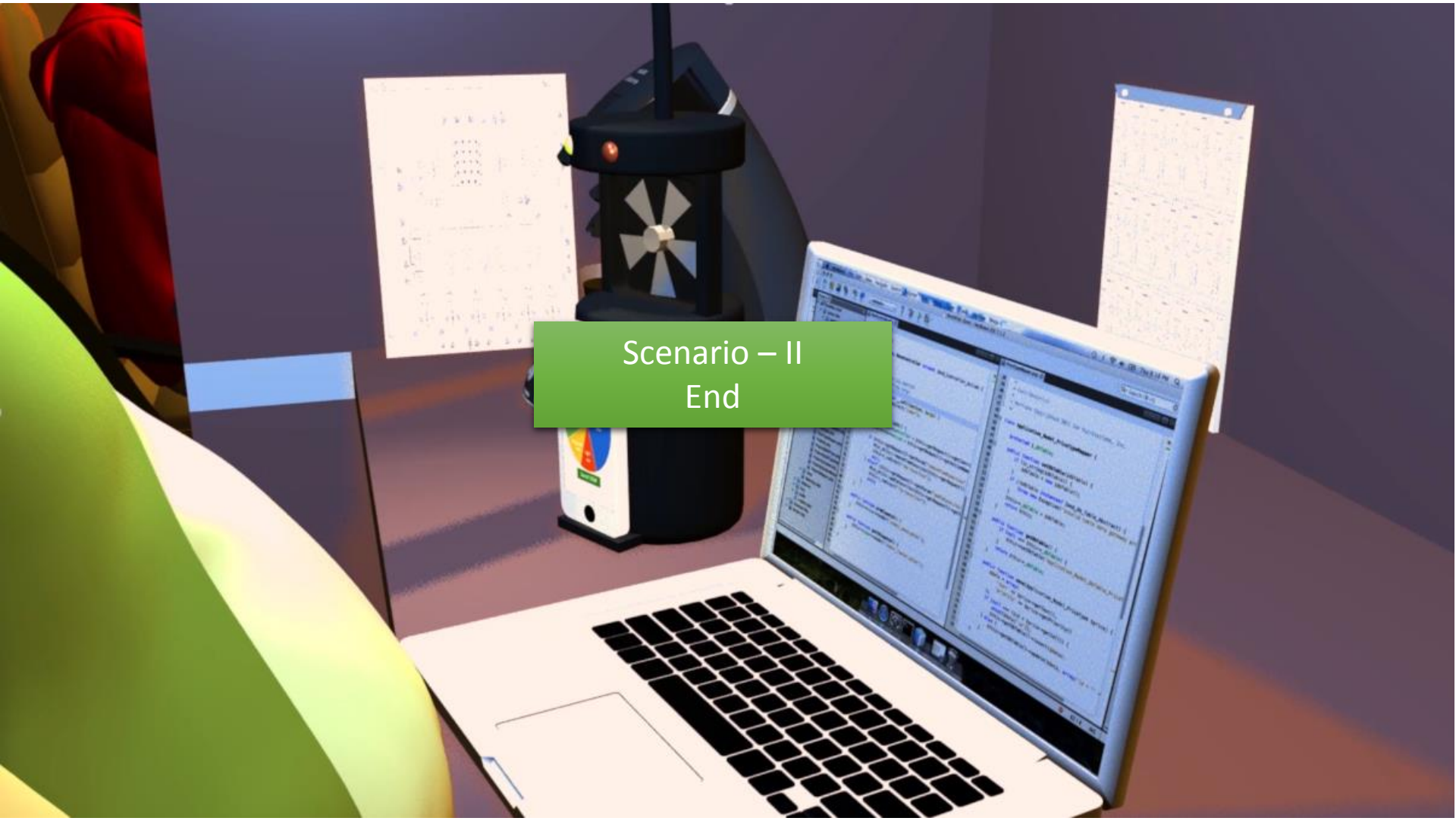

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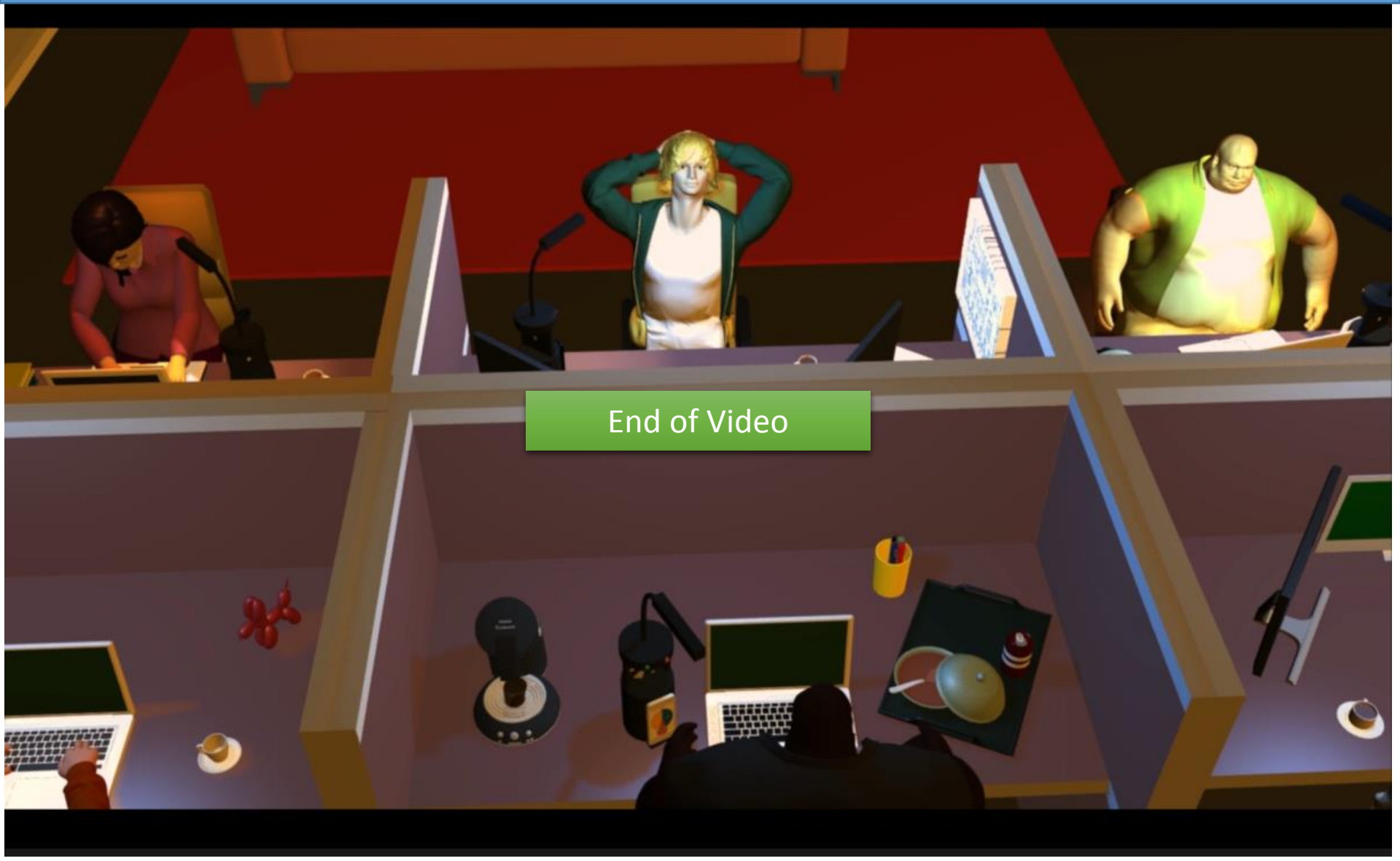

Questions?

vishal@iiit.ac.in