Integrated daylighting and glare control system

Designed for comfort and productivity

Leading in Los Angles Demonstration
Date: 4.28.19

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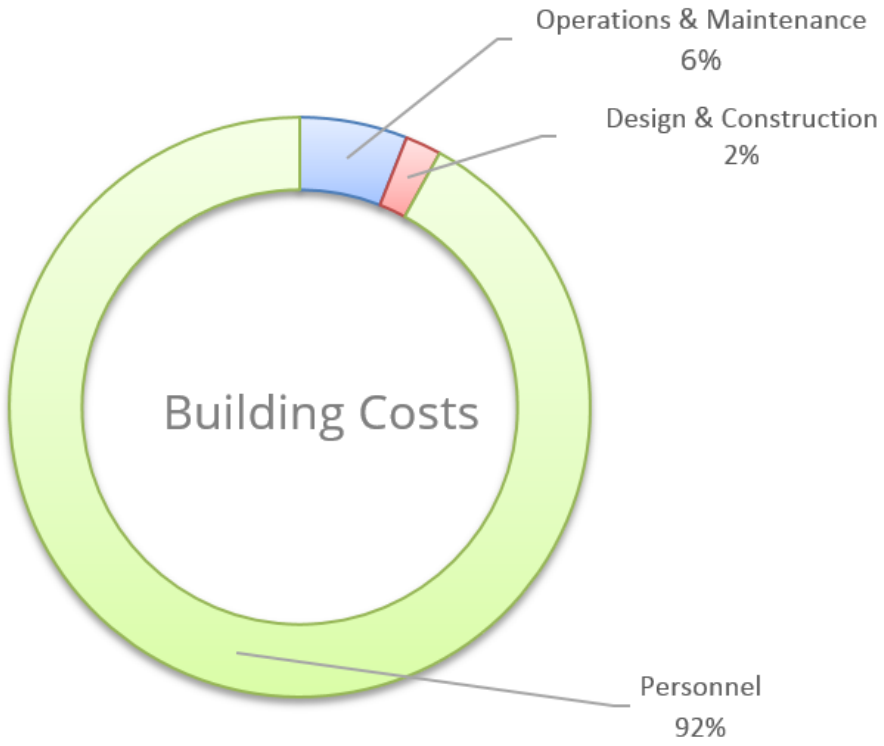
From lab to market

CEC/NBI project: Leading in LA

- Mindful of the $3, $30 ,$ 300 per sq.ft rule
- Solutions for existing buildings dwarf – Smart Retrofit
- The basis of the technology – ‘out of the box’ components, unique configuration, autonomous power, wireless controls
- The approach: broke window into 2 segments: 1) daylight redirection and 2) shade/vision/glare control.
- Experienced team
  - NBI
  - TRC
  - LBNL
  - System partners – Rollease Acmeda, Siemens, Enlighted, Daintree



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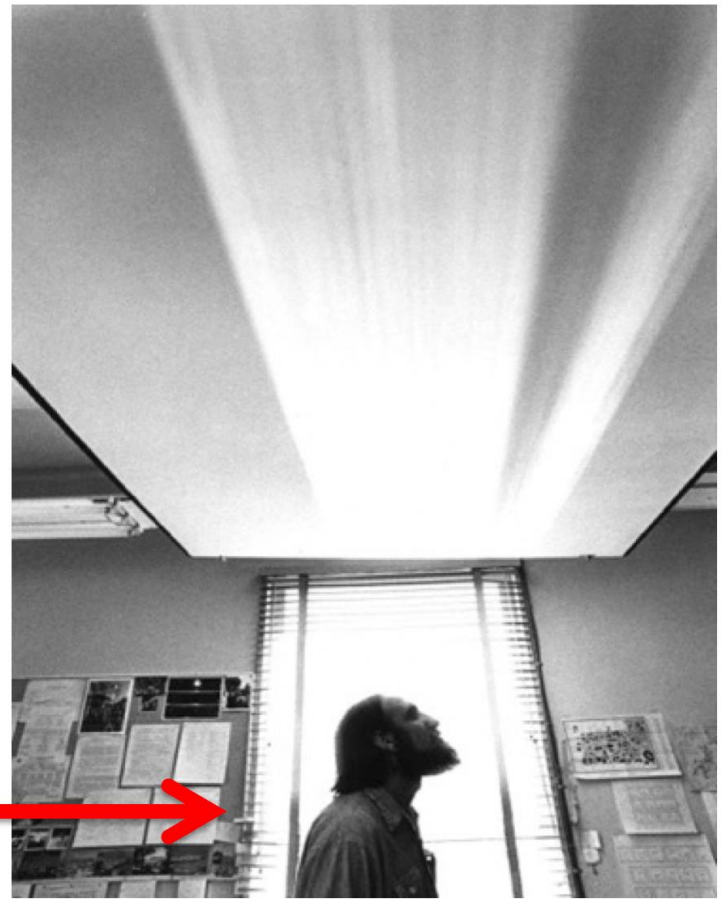
The opportunity and challenge

- The benefits of daylight and daylighting are well documented in the literature and demonstration projects:
  - Decades of research - LBNL, NREL, CEC, Heshong/Mahone, etc.
  - Customized one-off projects – NYT, Genentech, GSA
- The challenge and barrier widespread adoption has been the high cost of custom solutions, and complexity of control integration.
- The opportunity: a system employing ’off the shelf’ components to create an scalable/saleable integrated daylight and glare control system with user centric interface and attractive economics.

In the beginning….

- Daylighting Experiments ~1977
- LBNL office
- Venetian blinds: slats in upper 50 CM, modified with reflective coating
- 10 M deep daylight penetration with >500 lux
- Beam Daylighting: an alternative illumination technique: Selkowitz and Rosenfeld. Energy & Building 1977

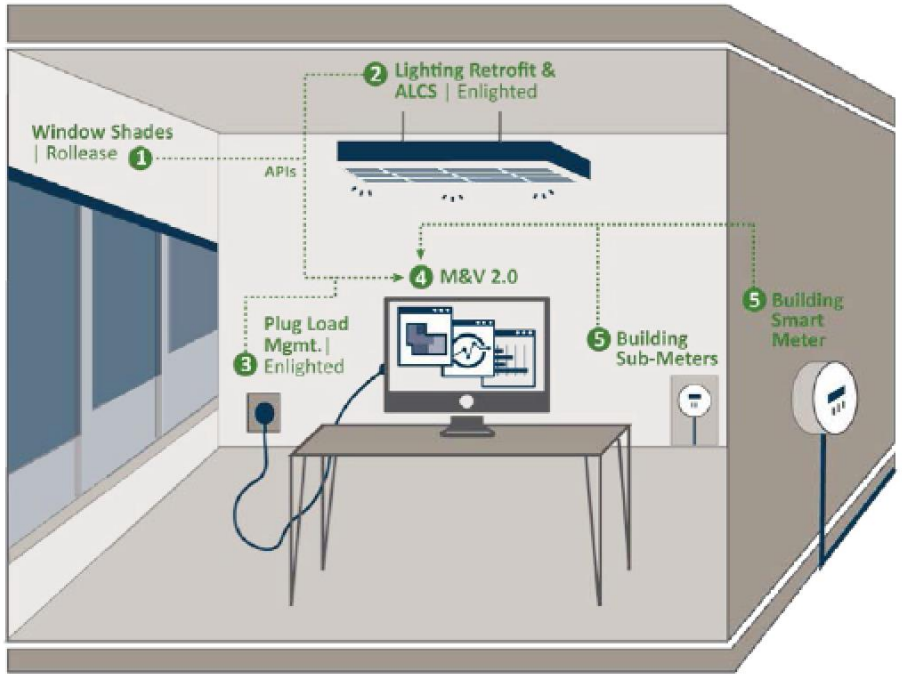
Young energetic researcher



Leading in Los Angeles

Project synopsis:

- ***Demonstrate scalable emerging energy efficient technologies*** *for networked façade, lighting and plug loads program.*
- ***Document Energy Savings Potential***. The study will measure energy savings of the combined technology package including automated daylight and shade control, both in the field and in the LBNL FLEXLAB.



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Santa Ana City Hall

- The Santa Ana City Hall is eight-story, 120,000 square foot office space.
- East-west axis. Built in about 1970.
- Single pane glazing, limited tint
- The window to wall ratio (WWR) is approximately 50% on south and north facades
- 500 Automated daylight and shading units. Wire-free power-supply and controls.

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Welch Hall – UC San Domingo Hills

- Welch Hall is a four-story, 160,000 square foot mixed use building constructed in 2002.
- Large light well provide considerable daylight availability on the upper three floors.
- Double pane glazing with limited tint. The WWR is approximately 20% to 50%
- 500 Automated daylight and shading units. Wire-free power-supply and controls.

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Building level savings predictions

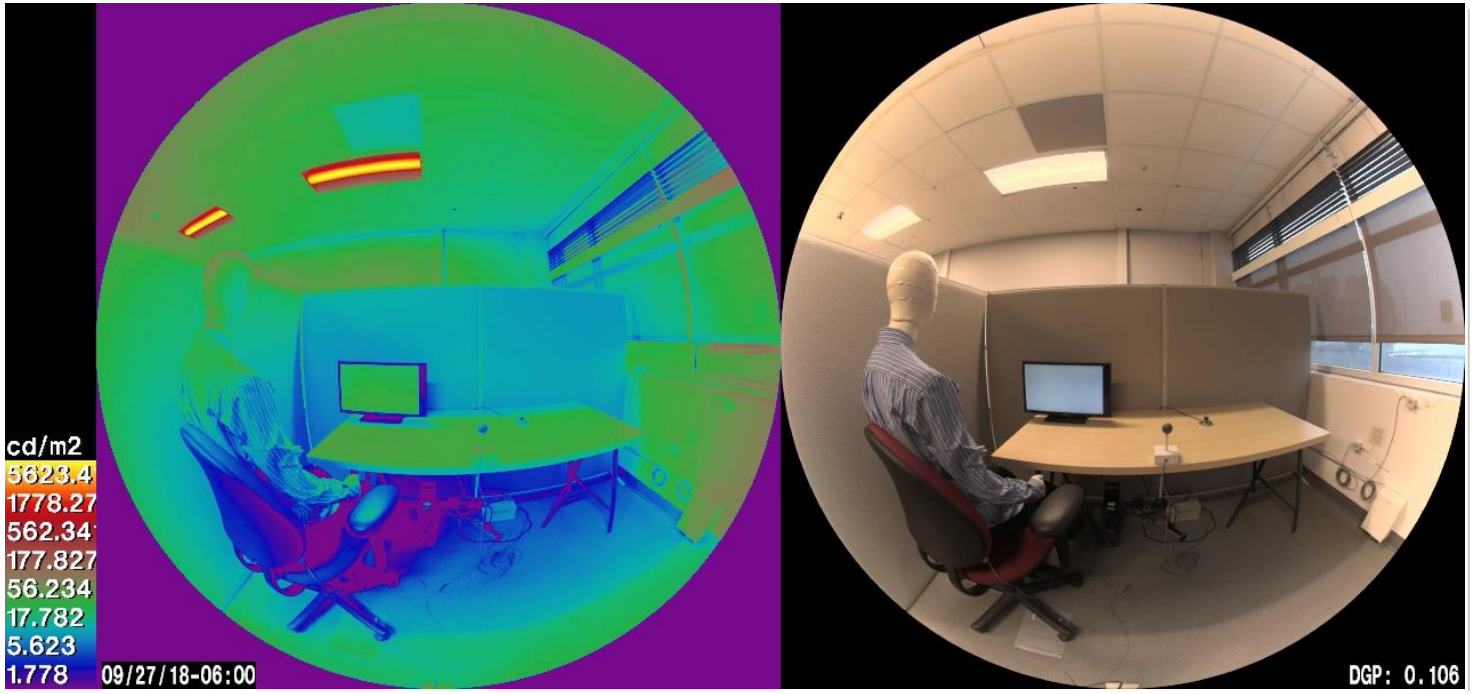
	% of Energy Use	End Use Savings	Whole Building Energy Savings
Lighting	37%	71%	
Equip. + Misc.	21%	5%	
Cooling	20%	15%	
Ventilation	14%	7%	
All other Loads	8%		
Totals	100%		**32%**
Building energy use values from CEC Attachment 12 Energy Efficiency Data.xls for GFO 16-304			

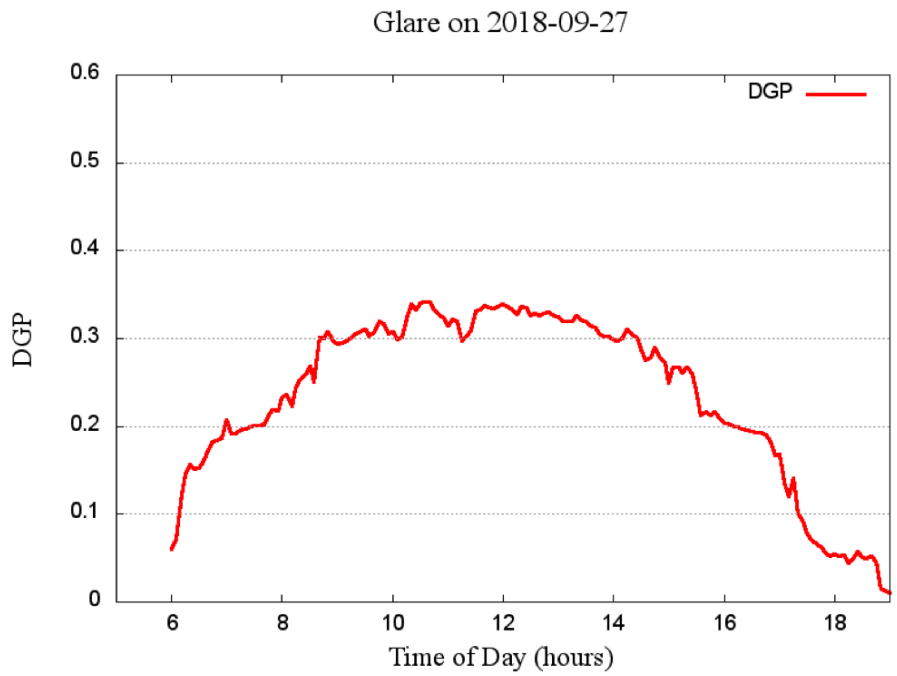
Savings Predictions: Lighting and Shades

- DOE beyond widgets modeling results of automated shading and lighting control:
  - Savings of 43-48% on south facing daylit zones
  - Savings of 25-30% on west facing daylit zones
- Larger savings expected for blinds with redirecting louver, that can increase daylight penetration approximately 50% deeper into a space
  - LBNL Flex lab results: *Preliminary*
    - 60-70% savings over 1 watt/sq.ft benchmark
    - 30-40% savings over Title 24 - 0.58 watt/sq.ft. benchmark

Flex lab @ LBNL – illuminance and glare performance

Scope: Comparison of Base case (venetian blind) and retrofit (light redirecting and shade) for summer, fall and winter seasons





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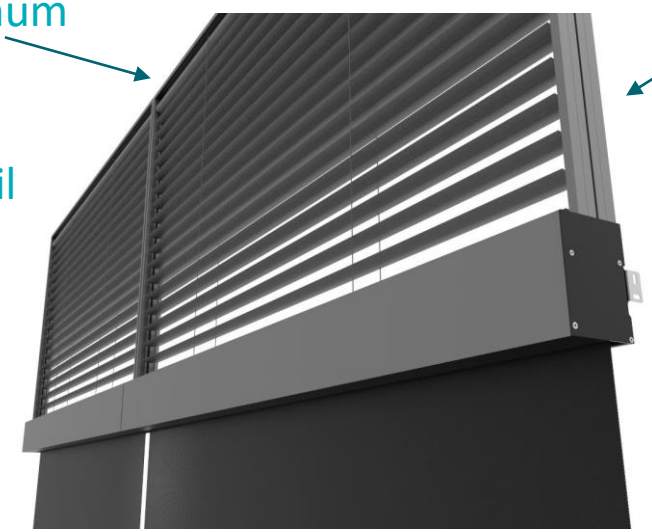
The vision…..

- *To provide solutions that support and promote health, wellness, reduce CO^2 and the use of fossil fuels.*
- *Economical to:*
  - *Specify*
  - *Fabricate*
  - *Install*
  - *Service and maintain*

Recycled Aluminum
- Reduces CO^2 emission
- Reduces fossil fuel use



Daylight harvesting improves productivity and well being

Solar powered – wireless motors and controls - NZE

Performance textiles
- Emit visible light
- Reflect IR
- Control glare
- Attenuate and absorb sound
- Privacy on demand or schedule to optimize performance

Textiles made from post-consumer recycled bottles, and pre-consumer waste
- Solution dyed to reduce water use
- Reduced carbon foot print
- Reduce use of fossil fuels

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Integrated daylight harvesting and solar control

An integrated solar powered system comprised of three distinct features:

- Motor controlled louver system intercepts and redirects sunlight onto the ceiling:
  - Application: South, East, West facing facades
- Motor controlled roller shades provides:
  - glare reduction by diffusing the natural light
  - maintains a view to the outdoors.
- 2-way RF control – Local, Room, zone, building
  - User over ride

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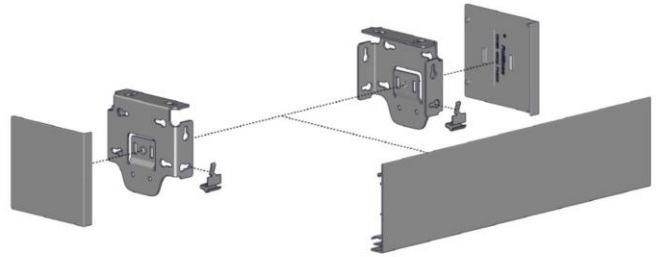
Automated Shades

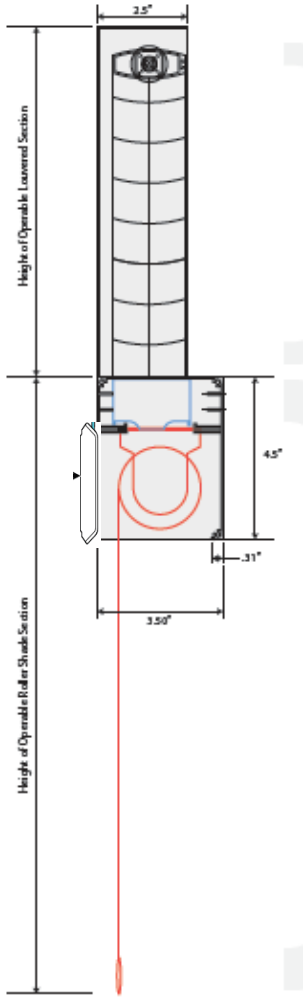
- Manages daylight and controls glare intelligently and economically.
  - Applicable for all orientations
- The system is comprised of:
  - Motorized wireless radio controlled solar control fabrics:
  - Power and Control
    - RF 433/Wifi Radio Controlled units are may be scheduled and operated locally via Pulse 2 hub
    - All units may be locally controlled via a provide wall mounted remote
    - Photovoltaic solar panels trickle charge Automate lithium ion battery packs which are integrated with each unit.



Hardware: brackets and fascia

Prefabricated units arrive ready to install

Factory Tested → Ready to Ship → Installed - Oakland



Roll over to watch video

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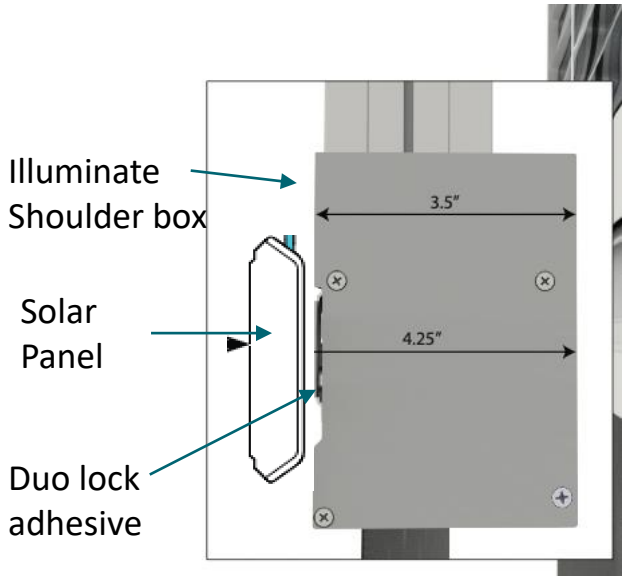
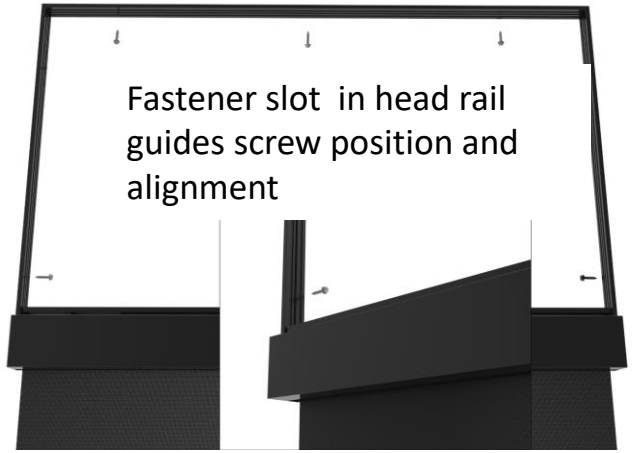
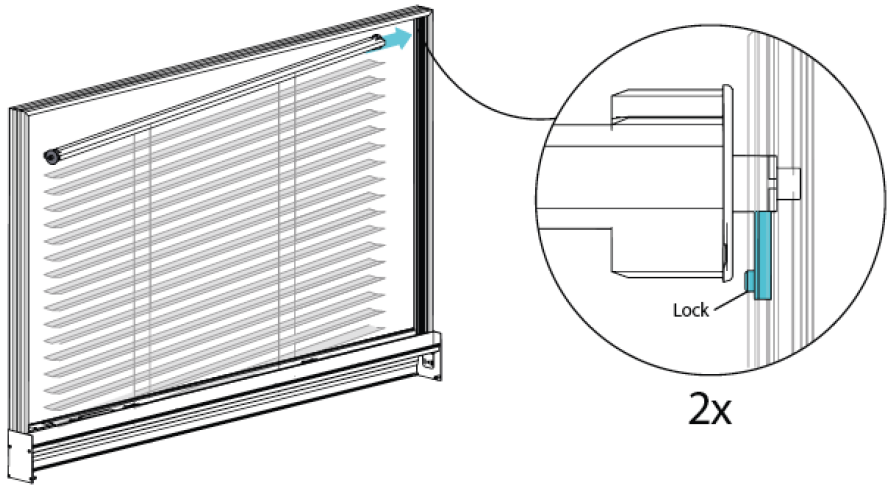
Install sequence minimizes field labor

1. Remove packaging
2. Install solar PV panel
3. Install Illuminate unit in window opening
4. Remove wrap from Louver stack and lift stack into place – insert pin ends above Pill
5. Calibrate upper and lower limit for shade







Ensure both the Pin ends rests securely over the Lock.

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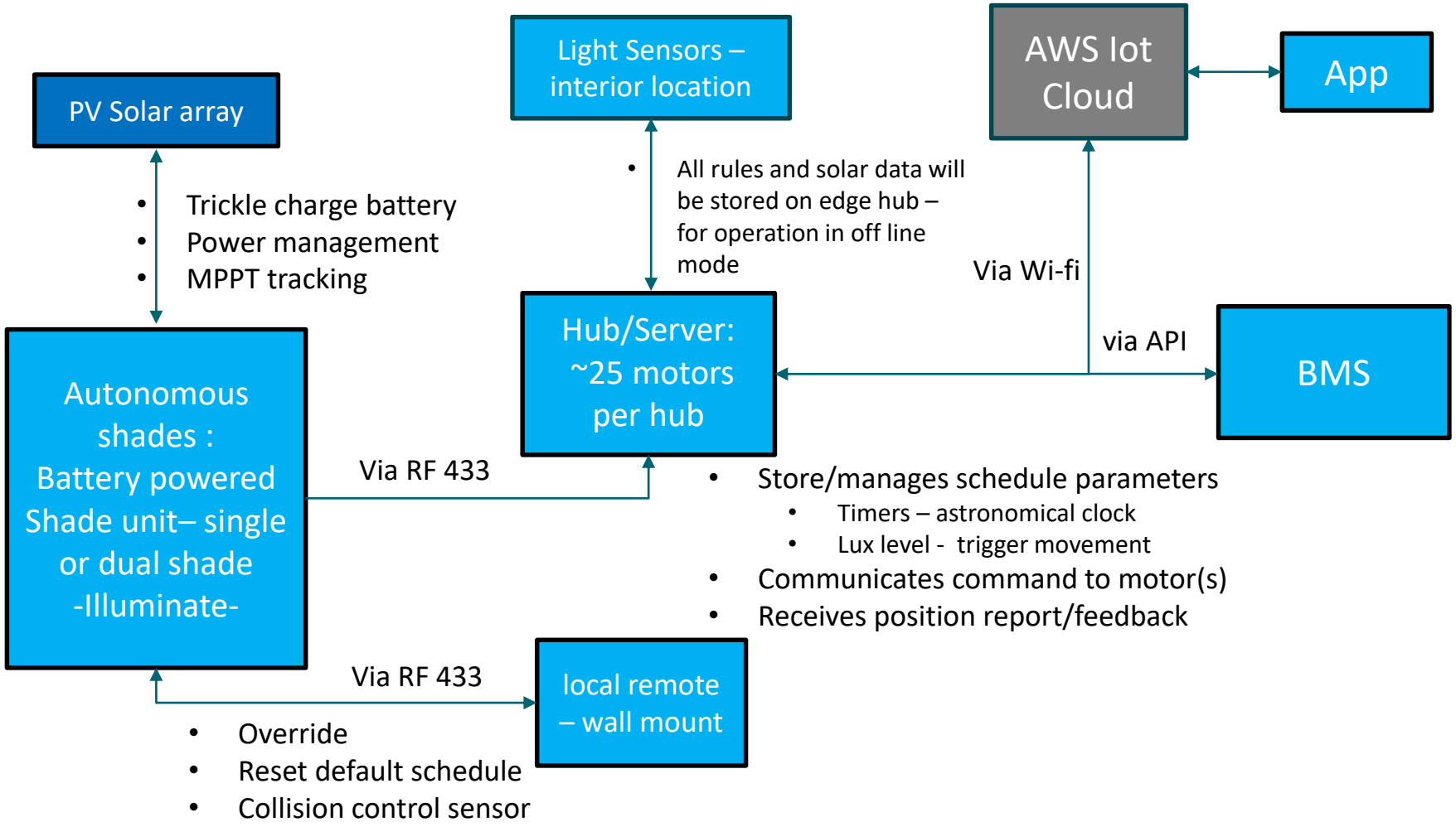
System Architecture



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Issues and challenges

- Gray zone of responsibility between installer and integrators
  - Setting device limits
  - Pairing and programming device level
  - Commissioning and verification – system level
  - Training – trade and user- UX
- Controls: simplicity and reliability of wireless 2 way RF to cloud integration
  - Economics
  - Personalized control - UX
  - Range / Interference
  - Power
  - Security
  - BMS vs stand-alone controls
- Solar charging and battery longevity

Thank you.

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