Smart Building Window Management System
For
SPD Smart Windows

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[**Note** – The Slide Numbers refer to the associated PowerPoint presentation. See http://www.spdcontrolsystems.com/Docs/Daylight_Harvesting.pdf]

1. Introduction

[Slide 18] Title Pages

My name is John Petraglia. I am the CEO of SPD Control Systems Corporation. In the audience is Peter Solaski, our Chief Technology Officer. Our company is licensed by Research Frontiers to design and manufacturer SPD electronic control systems.

[Slide 19] Topics

This presentation is a continuation of Greg's presentation. Greg discussed the advantages of SPD SmartGlass for daylight harvesting, energy efficiency, occupant comfort, glare control, aesthetics, privacy, and security. My presentation discusses how we are realizing many of these SPD advantages with our Smart Building Window Management System.

I will discuss why a Smart Management System is needed for larger buildings for determining the optimum balance between energy efficiency and occupant comfort. Then I will discuss the characteristics of our Smart Building System. I will conclude by presenting our contract with the New York State Energy Research and Development Authority, called NYSERDA, to build and demonstrate a prototype of our Smart Building System.

[Slide 20] Glass in Modern Construction

Glass walls are now predominant in high rise construction. Look at any new building and there is a preponderance of glass. The aesthetics are overwhelming for both the viewers and the tenants. But, there are associated problems including excessive energy usage, unsightly window treatments, lack of privacy, window glare, and fading - especially of art works.

[Slide 21] Energy Conservation, Daylighting and Glare Control

SPD SmartGlass and our Smart Building System is part of the solution to these problems. The U.S. Energy Department has estimated that rooms with windows that control tint could reduce lighting energy usage by up to 60 percent. Window treatments are not needed. Window tinting can block direct and reflected sunlight during times of peak glare.

[Slide 22] Occupant Comfort, Aesthetics and Privacy

Occupant comfort, aesthetics and privacy are inherent with SPD SmartGlass. Privacy is attainable with the very dark Hitachi and Isoclima films. And, the fading of a room's contents can now be controlled.

[Slide 23] Smart Energy Management

Commercially available wall and handheld switches can be used to change window tinting for a few rooms. The wall switches may have photo and motion sensors to automatically affect the tint of the windows. These off-the-shelf controls are satisfactory but will not provide optimum energy efficiency and flexible window tint control. This is especially true for larger buildings. Our Smart Building Window Management System is the solution.

[Slide 24] Examples

A Smart Building System is necessary for many reasons. Before I describe our System here are a few examples of what a Smart Window System can do,

(1) Optimizes daylighting to reduce lighting costs.

(2) Dynamically change the tint of a building façade as the sun transits across the facade.

(3) Automatically change the tint of one or more windows to preset levels during the day with different settings for the four seasons, workdays, evenings and holidays.

(4) Allows room occupants to override automatic tint settings for a fixed period of time and then revert to automatic tint levels.

(5) Allows building management to determine the balance of energy efficiency, daylighting and occupant comfort.

(6) Periodically accesses the utility companies cost of energy to dynamically determine the actual cost of energy for the lighting and HVAC (heating, ventilation and air conditioning) systems. This information is used to make intelligent window tinting decisions to optimize energy usage.

(7) Uses iPhones and other handheld devices to control the windows within a building.

[Slide 25] Opportunity Awaits

From just these few examples it is apparent that there is a need for more than room switches for larger installations. Building intelligence is the key to maximizing the many benefits of the dynamic tinting of SPD SmartGlass.

[Slide 26] Concept to Reality

The implementation of a Smart Building Window Management System is complicated. There are constant dynamic decisions to be made to balance energy efficiency and occupant comfort. Our Smart Window System allows building administrators to control and manage their buildings dynamic windows. This is achieved by monitoring environmental conditions, using Building Window Profiles and executing a set of rules, called Algorithms.

An intelligent control system for SPD Smart Windows requires a complex communications network to connect and control the potentially hundreds of sensors and hundreds of window controllers in a large building. The intelligent software must be capable of automatic tint control at many different levels. Examples are windows in rooms, windows for tenants, and windows comprising a building's façade. Our system uses sophisticated technologies such as wireless mesh networking and advanced algorithms to manage these complexities.

[Slide 27] Monitor Environmental Conditions

The environmental conditions include light levels using light sensors, room occupancy using motion sensors, time of day tint levels using user defined parameters, real-time energy cost using an interface to the utility company and sun position using sun transit calculations.

[Slide 28] Building Window Profiles

Building Managers have different requirements for balancing energy efficiency with daylighting, glare control and occupant comfort. They may want tenants to have some control over these parameters for their offices or have one set of rules for the entire building with just minimum manual overrides by room occupants. The set of requirements for a building is called the Building Window Profile.

[Slide 29] Algorithms (Rules)

Algorithms - also referred to as processing rules - use environmental conditions and a Buildings Window Profile to control tint for optimum building energy efficiency and occupant comfort. Algorithms provide for the automatic operation of the windows including preset settings, sensor mode and glare control. Presets provide the times in the day when tint settings change to a designated value. Light and motion sensors automatically control the tint based on sensor detected changes. The system is designed to be able to add algorithms as required.

[Slide 30] Smart Building System

Our Window Management System controls only the dynamic windows. It is one system of many dedicated building systems including HVAC, lighting, and security. A Master Building System integrates all of a buildings dedicated systems allowing them to work together. The need for a Master Building System is compelling considering that the currently available non-integrated building systems typically waste 50 percent of a building's energy.

Smart Building Systems are in an early stage of development. Each system manufacturer uses different networking standards and provides minimum communication with other manufacturers systems. This makes it difficult to integrate the various building systems. The movement toward achieving significant energy savings is causing the building system industry to define standards to facilitate the interoperability of building systems and allow a Master Building System to manage the dedicated systems.

Our Smart Window Management System provides a standard network interface, called XML, to allow integration with other dedicated systems and an eventually to a Master Building System. For example, a Master Building System can control window tinting via our external interface. Another example is that our system can accept sensor readings from other building systems eliminating redundant sensors.

[Slide 31] Prototype Building Energy Management System

SPD Control System Corporation (SCSC) is currently developing a prototype of our Smart Building Window Management System under a contract with the New York State Energy Research and Development Authority (NYSERDA). It is a sophisticated intelligent control system for small buildings to skyscrapers.

The system components include SPD wireless window controllers, wireless handheld remote units, a window management system, window switches, photo sensors, motion sensors and a state-of-the-art ZigBee wireless communication network.

[Slide 32] Key Points

The key points of this presentation are,

(1) A few SPD rooms may not require a Smart Window Management System. But, there are major benefits for larger installations to skyscrapers.

(2) Our System provides optimum energy efficiency, occupant comfort, and comprehensive user control. The energy saving would pay for the system in a short period of time.

[Slide 33] Contact Information

I hope that this discussion has given you a better understanding of the benefits of our Smart Building Window Management System. Thank you for your attention.