



## ORGANIC RESPONSE

*Lighting control from a very different perspective.*  
Text: Andy Ciddor

Danny Bishop is an engineer who doesn't believe that central control is necessary for energy-efficient lighting in large areas. Quite the contrary. He's of the opinion that a swarm of autonomous luminaires, each with just enough local intelligence to control the lighting for one small area of a large space, can provide the most cost-effective and energy-efficient lighting possible. The upshot of that concept is Organic Response (OR), an Australian lighting control system developed by Bishop, that could make a significant impact in lighting commercial building spaces.

Organic Response's distributed intelligence system places a small sensor and control node in each luminaire, and gives it the capability to control the luminaire's level and influence the behaviour of its near neighbours. The node contains an 8-bit PIC microcontroller talking to a quad-element passive infrared (PIR) motion sensor, a proximity-limited infrared transmitter, a narrow-field infrared receiver and an ambient light level sensor. Luminaire output is driven by a connected ballast control module, with modules currently available for either 1 to 10V or DALI-controlled ballasts.

For reliable operation, luminaires must be installed between 2.4m and 3.7m above floor height and may be spaced with their OR sensor nodes at distances ranging from 1m to 3m. At an elevation of 2.5m a node's PIR sensor array covers an area of approximately 6m by 7.5m at floor height.

### THE SWARM IN ACTION

When the PIR in an OR sensor node detects movement at the same time as an insufficient light level is sensed, the node raises its luminaire to a preset 'occupancy detected' light level (such as 100 per cent) and holds it there for a preset dwell time. The node simultaneously broadcasts a level 1 occupancy message via its downward-facing, proximity-limited, infrared transmitter.

Any neighbouring node receiving the reflected level 1 occupancy message via its downward-facing, narrow-angle infrared receiver responds by raising its luminaire to a preset 'nearby occupancy' level (such as 75 per cent) and holds it there for the preset dwell time, unless a further message is received. The receiving node simultaneously broadcasts a level 2

occupancy message via its infrared transmitter to notify its neighbours that there is an occupant two luminaires away.

Each node receiving the level 2 message is triggered to raise its luminaire to the 'distant occupancy' preset level (such as 50 per cent), which it then holds for the preset dwell time, unless a further message is received. Occupancy information propagates rapidly throughout the space, creating a pool of light around each occupant, without the need for any central control or defined communications architecture.

To avoid plunging the space into darkness, if no further movement is detected during the dwell time the node fades the luminaire down to a low 'previously occupied' level (such as 25 per cent) over 30 seconds, and after a further preset period (such as five minutes), fades the luminaire off.

The PIR movement detector is sufficiently sensitive to be triggered by everyday work activities such as watching cat videos or updating your Facebook. In the very thorough field trial undertaken by consulting engineers Arup at Level 9 of the CBA head office at Darling Park Tower 1 in Sydney, none of the participants was plunged into darkness, even when undertaking normal office activities. (The full report on this field trial is available on the OR web site.)

All operating parameters such as the level and dwell presets of each OR sensor node can be modified in the field through the use of an infrared transceiver connected to an iOS device (iPhone/iPad/iPod) running OR's control app.

By integrating the capability of daylight-sensitive and occupancy-aware lighting into its minimal installation and commissioning system, Organic Response has developed a responsive and very fine-grained control system that holds the potential to have an enormous impact on energy-efficient lighting for large open commercial spaces. It's currently negotiating with leading fixture manufacturers in both Europe and Australia to take OR-equipped luminaires to market. We'll keep you informed of their progress in the news pages of the **Light+Design** web site. ►

Organic Response: (03) 9486 9823 or [www.organicresponse.com.au](http://www.organicresponse.com.au)