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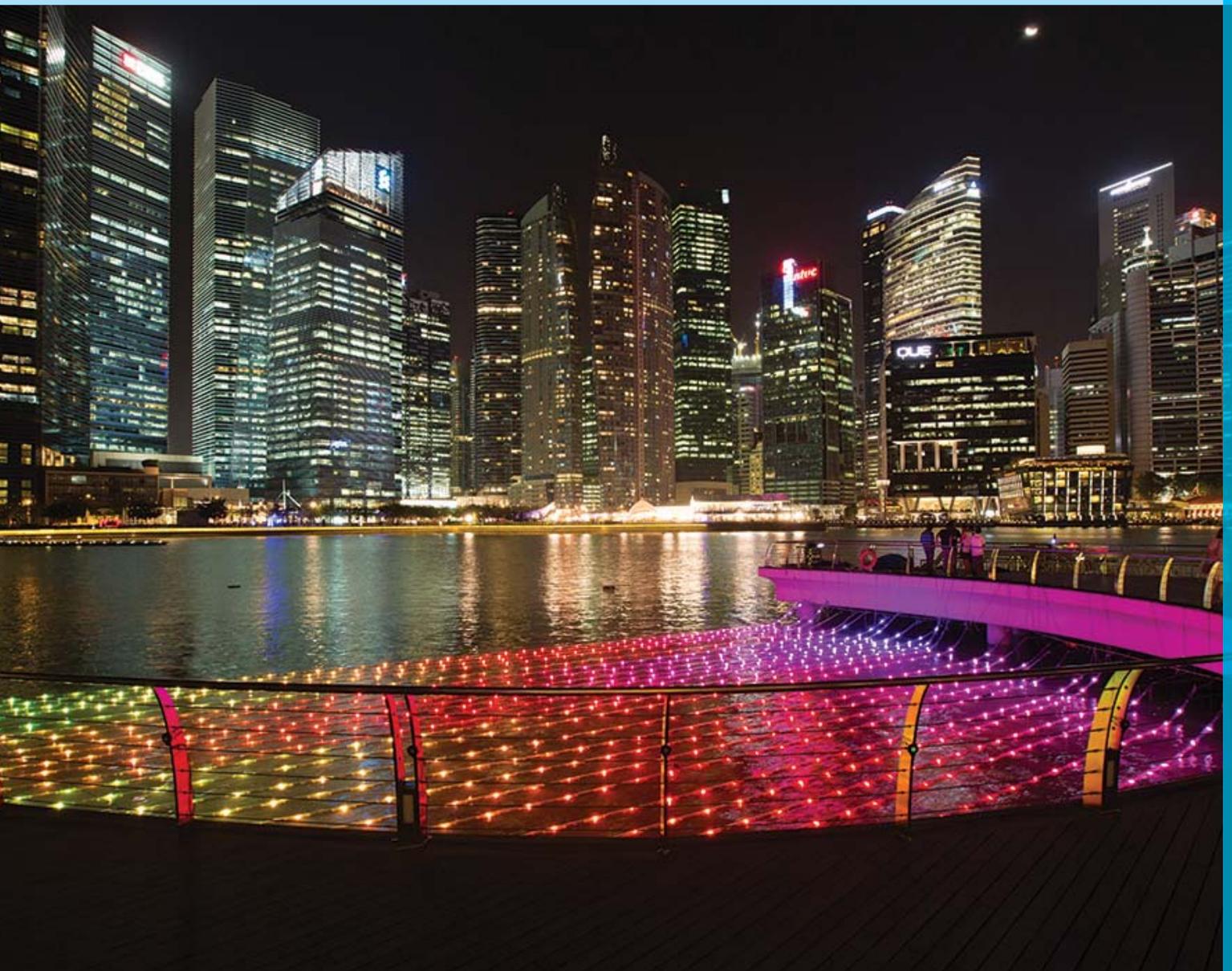
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# THE SINGAPORE ENGINEER

COVER STORY:

## SUSTAINABILITY

Interactive lighting experiences at 'i Light Marina Bay 2014'



FEATURES:

Power Generation • Security Systems • Systems Engineering



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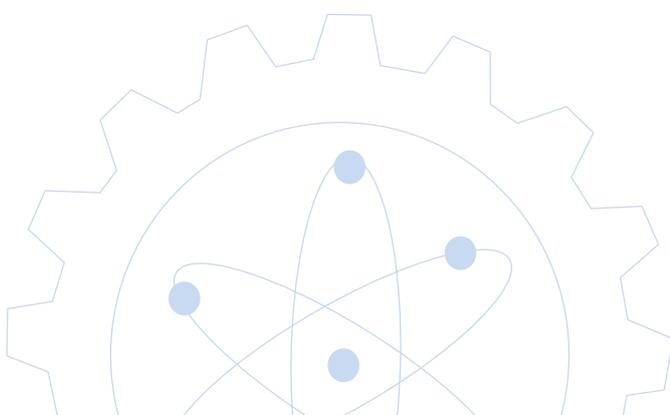
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# Interactive lighting experiences at 'i Light Marina Bay 2014'



The cells of iSwarm illuminate the waters of Marina Bay with LED lights.

Two interactive installations at 'i Light Marina Bay 2014', made possible through advanced LED technology provided by Philips, have demonstrated how LED solutions can go beyond functional aspects such as safety, navigation and sustainability, to effectively beautify urban landscapes, as well.

i Light Marina Bay 2014, the sustainable light art installation festival, was held from 7 to 30 March 2014.

Philips was also the partner for the festival's 'Sustainability Workshop' which was held on 26 March.

The two interactive works at i Light Marina Bay 2014 are 'iSwarm' by Singapore University of Design and Technology (SUTD) and 'BEAT' by design and engineering firm Arup.

## iSwarm

This is the first time that a team from SUTD is participating in iLight Marina Bay. The ingenuity of this installation, uniquely sited in the water, demonstrates the innovative ideas and creativity of the school and faculty members behind this first-of-its-kind installation. This installation is exemplary in its advancement into a new frontier in light art installation presentation, where collaborative efforts and research are needed to enrich the experience of interactive arts in today's context.

iSwarm is a swarm of luminous 'sea creatures' that interact

with passers-by. Subtle and hardly visible by day, iSwarm comes alive at night. As daylight fades, the cells of iSwarm illuminate the waters of Marina Bay with LED lights that appear to be fluorescent light reminiscent of natural phenomena such as bioluminescent algae or the Aurora Borealis. It reacts to groups of visitors by detecting human presence and greeting them with subtle modulation of its light patterns.

## The design concept

The behaviour of the artwork is based on a swarm-simulation. Without the presence of visitors, only a small swarm of 'predators' is active, resulting in swirling gradients from light blue to dark purple. When visitors trigger the sensors, 'prey' are released. The predators chase the preys, leading to a more vivid display of lights, with the colours from the predators mixing with the preys' yellow-greenish colours. Eventually, preys tend to be caught and eaten by the predators. Predators that are unsuccessful in catching prey for a longer period die from hunger, while successful predators can reproduce. Contrastingly, the birth of new preys is triggered by the visitors.

In that way, ecological feedback is created between the behaviour of the artwork and the actions of the visitors. If there are too many predators relative to the number of preys (ie relative to the amount of visitors), the predator population will shrink. If, on the other hand, there are many more preys than predators

(for example when many visitors arrive at the same time), the preys will quickly be consumed by the rapidly growing swarm of predators. In short, the behaviour of the artwork is dictated by a simulated ecology that adapts to the presence of visitors in a rigorous, yet subtle manner.

### Technical details and prefabrication

More than 1500 LEDs (iColor Flex LMX) which were co-sponsored by Philips Lighting, were used. The iColor Flex LMX are flexible strands of 50 large, individually addressable, full colour LED nodes. Each node can produce a maximum of 6,56 candela of light output while consuming 1W of power. A power supply with an inbuilt Ethernet controller allows individual nodes to be addressed via the processing program developed by SUTD.

These LEDs are deployed just below the water surface. After exploring a variety of waterproofing methodologies, including vacuum formed housings, cast silicon casings, and 3D printing, the design team settled on deploying the lights within customised extrusions of clear PVC hosing used in the medical and food service industries. The design team worked directly with the manufacturer to design a bespoke hose extrusion that was both large enough to encase the lights, but flexible enough to ensure workability on-site. The layout of the lights was designed such that they created an evenly dispersed grid composed of equilateral triangles. This layout accommodated the most even movement of the swarms across the field of lights. In total, the installation comprised 1500 LEDs strung through 1 km of PVC hose and covering an area of 475 m<sup>2</sup>. Prefabrication of waterproofed light stands with custom spacing took more than 2000 man-hours over a period of one week.

A total of 32 passive infrared (PIR) sensors were deployed on land, surrounding the perimeter of the installation. These sensors detect the movement of people as they approach the installation. Sensor data was acquired by an Arduino Mega which communicates with the processing program. Waterproof housings for the PIR sensors were designed and 3D printed in-house at SUTD. As 3D printers have fewer limitations as compared to other means of production, such as CNC-milling, casting or vacuum forming, the potential for the exploration of the formal and functional qualities of the housings opened up tremendously.

### Installation

The installation methodology initially considered was to deploy prefabricated pier-to-pier rigs and hooks with customised spacing, to facilitate the easy set-up of the rubber hose lines. However, the on-site conditions deviated both from the as-built drawings as well as preliminary site measurements. The water/tide level also increased, thereby requiring significant



*'BEAT' demonstrates the potential of programmable digital light sources in ever more meaningful ways.*

offshore improvisation of the prefabricated pier-to-pier rigs, which set back the actual installation process. It took a total of more than 400 man-hours within a day, to complete the process of installing the LED lights and sensors.

### BEAT

With Philips hue, a leading personal wireless lighting system, the creative team from Arup demonstrated the potential of programmable digital light sources in ever more meaningful ways through its light art installation 'BEAT'. Arup's installation is designed to be inclusive and fun and promote sustainability. When people interact with the translucent shapes displayed, the installation responds visually with pulsating light, with the colours intensifying as more people interact.

With a comprehensive portfolio of installations activating public spaces globally, Arup combines art, science and technology with a passion for light.

### Philips

As a leader in LED lighting, Philips is committed to offering innovative and environmentally friendly lighting solutions to improve people's lives. The company believes that iLight Marina Bay provides an ideal platform that enables it to work with top designers to showcase the new possibilities that digital and connected lighting can deliver.

Urbanisation is making cities more populous and more numerous. This rise of cities has created competitive desires to establish a strong city identity with a higher quality of life and conditions for strong economic growth. Philips believes that an intelligent, connected public lighting infrastructure can enhance the liveability of cities by creating a resource-efficient city that contributes to the safety and security of all citizens, and establishing an attractive, vibrant image. In the achievement of these objectives, connected digital lighting can play an increasingly important role.

Images by Philips.