ROLE OF IoT IN A SMART CITY CONNECTED COMMUNITY

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President, IEEE Power & Energy Society, 2018-2019

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IoT Applications in Agriculture, Transport, Healthcare, Energy
How Do You Make a Large Number of IoT Devices Work Together?

Need a Software Platform

An Open-Architecture Platform for IoT Device Integration
Multi-sensor Applications

Classroom Under Real-time Monitoring

- BEMOSS Core
- BEMOSS Zone 1
- BEMOSS Zone 2
- Power meter
- Environmental sensor (CO2, noise, temperature)
- Thermostat
- Motion sensor
- Plug load controller
Indoor Environmental Monitoring

Smart Light-Intensity Control
Energy Savings By Controlling Light Intensity

Based on occupant requirements, light intensity level was reduced during October – December 2016. Results indicate the average kWh savings of about 34%.

<table>
<thead>
<tr>
<th>Month</th>
<th>Total Measured Energy Consumption (kWh)</th>
<th>Total Calculated Energy Consumption without Dimming (kWh)</th>
<th>Energy Savings by Dimming (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 2016</td>
<td>264.37</td>
<td>399.90</td>
<td>33.89%</td>
</tr>
<tr>
<td>November 2016</td>
<td>278.13</td>
<td>423.78</td>
<td>34.37%</td>
</tr>
<tr>
<td>December 2016</td>
<td>280.76</td>
<td>426.40</td>
<td>34.16%</td>
</tr>
<tr>
<td>Total (October-December)</td>
<td>823.26</td>
<td>1250.08</td>
<td>34.14%</td>
</tr>
</tbody>
</table>

Note: Scheduled dimming level from 6:30am to 9:00pm. Open office area A: 50%; Open office area B: 45%; Chief office’s desk area: 60%; Chief office’s meeting area: 50%; Conference room A: 50%; Conference room B: 45%. Lights are off after 9:00pm.

Smart Campus

- Utility/Demand Response Aggregator
- HVAC
- Lighting loads
- Plug loads
- Power meters
- Water meters
- PV & storage
- Security camera
- Customers/Operators
- Buildings
- Internet
Electricity Savings in Street Lighting

People/cars are clearly visible under the white LED light.

HPS vs LED

Existing HPS Lamps (Dec 2010)

New LED Lamps (June 2012)
ICT-based Lighting Intensity control (80%)

Infrared Sensors to Monitor Traffic

ICT-based control to dim lights to 50%
HPS vs LED
Monthly Electricity Consumption

- Average electricity **savings of 75%** was experienced after the installation.
- Avoided CO2 emission was **6,127 kg/year**.

<table>
<thead>
<tr>
<th>Month</th>
<th>HPS (2011)</th>
<th>LED (2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>1,289</td>
<td>371</td>
</tr>
<tr>
<td>Feb</td>
<td>1,000</td>
<td>294</td>
</tr>
<tr>
<td>Mar</td>
<td>1,306</td>
<td>215</td>
</tr>
<tr>
<td>Apr</td>
<td>1,216</td>
<td>232</td>
</tr>
<tr>
<td>May</td>
<td>372</td>
<td>246</td>
</tr>
<tr>
<td>Jun</td>
<td>1,123</td>
<td>276</td>
</tr>
<tr>
<td>Jul</td>
<td>1,264</td>
<td>258</td>
</tr>
<tr>
<td>Aug</td>
<td>1,384</td>
<td>325</td>
</tr>
<tr>
<td>Sep</td>
<td>1,200</td>
<td>315</td>
</tr>
<tr>
<td>Oct</td>
<td>1,528</td>
<td>330</td>
</tr>
<tr>
<td>Nov</td>
<td>1,466</td>
<td>329</td>
</tr>
<tr>
<td>Dec</td>
<td>1,382</td>
<td>315</td>
</tr>
</tbody>
</table>

Public Safety In a Sustainable Smart City
Cities across the world are deploying technology to gather data trying to become cleaner, reduce traffic, and improve urban life. Starting with energy management, to disaster preparedness, to public safety, to parking spot assistance, to paying bills online, to facilitate emergency vehicle movement, and much more.
Elements of a Smart City

A neighborhood in a smart city:
- A smart traffic crossing sensitive to traffic volume
- Synchronized traffic lights for smooth flow
- Emergency vehicle priority access

Connected Transportation

- Connected vehicles and travelers will be able to share data with all sorts of equipment, and be able to procure mobility as a service, whenever wherever:
Stockholm City Traffic Management

The system allows buses that are more than a minute behind schedule to automatically receive priority at traffic lights.

US Deployment: Smart Lamppost with Camera

Camera provides surveillance and locates empty parking spaces.
Smart Trash Can in Stockholm, Sweden

Regular trash cans need to be emptied 1–3 times per day. Smart ones only need to be emptied four times a week.

Yokohama, Japan Smart City Demonstration
Commercial Deployment

www.bemcontrols.com

Thank You

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