Energy efficiency and sustainability are talking points for companies and people alike. However the building management is unable to do justice towards these goals due to legacy, disparate and proprietary building systems. Such systems have limited accessibility, require manual operation and are limited to schedule based automation. Efforts to optimize the building operations in such a setup are often disruptive and capital intensive.

### Challenges with current building setup

<table>
<thead>
<tr>
<th>Isolated Buildings and Systems</th>
<th>Inefficient Manual Operations</th>
<th>Inefficient Schedule Based Automation</th>
<th>Limited Accessibility of Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local operations because of proprietary systems</td>
<td>Manual intervention for data capture, equipment controls and tracking of occupant comfort</td>
<td>Automation is based on data from isolated systems leading to static schedule based automation</td>
<td>Real time data and insights restricted to control rooms. Senior management is dependent on offline reports</td>
</tr>
<tr>
<td>High Energy Consumption</td>
<td>High Operational Costs</td>
<td>Lower Occupant Comfort</td>
<td>Lack of Real Time Actionable Insights</td>
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</tbody>
</table>
GHD Digital and Mindtree collaborating on a broad Digital platform targeted to the property and infrastructure sectors

Mindtree and the global professional services company, GHD, have established a partnership to transform how clients in traditional property and infrastructure industries can deploy Digital platforms to help run their business more efficiently and elevate the experience of their customers.

Solution - Gladius Connected Buildings Platform

Gladius Connected Buildings is a powerful IoT based open platform that brings visibility, actionable insights and intelligent automation to the entire building portfolio without the need for high capital expenditure. It is a scalable platform that grows as you add buildings and systems while retaining flexibility in choice of vendor. The platform seamlessly integrates all your streams of data from:

- **Operational Technology (OT) systems** such as HVAC, cameras and fire security systems
- **Enterprise IT systems** such as ERP & ticket management system.

Gladius Connected Buildings enhances energy efficiency and sustainability by enabling transition from individual component-level optimization to holistic optimization. It delivers automated, continuous optimization based on real-time conditions and enables the workforce to focus on buildings and systems that need most attention.
Reference architecture (IOT for Connected Buildings)

Edge HW module
- Video management
- Visualization + User interface console
- Push to server at desired frequency
- Video / image analytics
- Device discovery
- Device management
- Device Onboarding and data telemetry
- Actuations
- Rules and schedules
- Protocol conversion

Sensor data
- Equipment – HVAC/ lighting
- Camera – CCTV network
- Custom networks – SCADA and others
- Custom edge nodes

Machine learning/ Analytics
- Anomaly detection
- Rules optimization
- Commodity forecasting
- Feed out to BI environment

Event processing
- Message Broker
- Stream processing bolts
- Alerts
- Rules & alarms cache

Device onboarding
- Device register
- Device status tracking
- Asset and location mapping
- Commodity mapping & config

Scheduler
- Scheduled Rules
- Rules runtime
- Aggregation Batch Jobs
- Archive jobs
- Action triggers

Web Application
- Dashboards
- Reports
- Rules config
- Actions APIs
- User management/ Authorization

Adapters
- Email
- Maps
- Trigger Action APIs R/W

Integrations
- Location aggregates APIs
- Commodity data APIs
- Asset and device data APIs

Security
- HTTPS
- Web access
- Browser
- Mobile app

External services
- Google Maps / OpenStreetMap.org
- SendGrid

Technologies used: C++ for Edge HW module, AWS IoT Core, AWS Kinesis for stream processing, AWS Stepfunctions for Orchestration, CloudWatch events for Scheduler, AWS Sage maker for Machine learning/Analytics, Java based APIs for integration, Power BI for Dashboards, AWS Dynamodb for Config and master data & SendGrid for emails

Benefits:
- Integrated building portfolio
- Unify buildings across locations
- Unified dashboard and controls
- Enterprise IT integration
- Actionable Insights
- Benchmarking and comparative analysis of buildings
- Augmentation of video analytics with IoT Analytics
- Granular energy usage trend analysis
- Intelligent Automation
- Sense & respond with integrated camera + IoT analytics
- Multidimensional intelligent controls (Ex - Based on Occupancy and external environment)
- Early warning signals through automated ticket generation for faults

About Mindtree
Mindtree (NSE: MINDTREE) is a global technology consulting and services company that enables enterprises across industries to drive superior competitive advantage, customer experiences and business outcomes by harnessing digital and cloud technologies. A digital transformation partner to more than 260 of the world’s most pioneering enterprises, Mindtree brings extensive domain, technology and consulting expertise to help reimagine business models, accelerate innovation and maximize growth. As a socially and environmentally responsible business, Mindtree is focused on growth as well as sustainability in building long-term stakeholder value. Powered by more than 31,900 talented and entrepreneurial professionals across 24 countries, Mindtree — a Larsen & Toubro Group company — is consistently recognized among the best places to work. To learn more about us, visit www.mindtree.com or follow us @Mindtree_Ltd