

## Buildings of the Future

### Introduction

For many centuries, people have been building shelters to provide comfortable as well as safe living spaces for them. Modern day buildings achieve the same goal of providing human comfort and safety by integrating complex engineered systems including lighting, heating, ventilation, air conditioning, daylighting, security, etc. Over time, each of these building systems has been perfected to increase human comfort, safety and productivity. Today, building designer must embark on a different course to design smart buildings that provide comfortable, secure, productive and enjoyable environment with the least impact to the surrounding environment over the entire life cycle of the structure so that this habitat for humanity remains livable for generations to come.

### Smart Building Features

Smart buildings of the futures will leverage the information technologies to allow the flow of information among many subsystems. Sharing of information among many subsystems is now possible as manufacturers has adopted standardized communication protocol such as BACnet®, Modbus®, and LonWorks®, enabling the entire system to function as a complete unit. As an example, occupancy data from security systems can be used to schedule cooling/heating cycle based on actual demand and control lighting based on the same data.

Smart buildings of the future will also share information with systems outside their four walls, enabling a smart electrical grid to evolve. Two way communication between the grid and buildings will empower grid operators, building occupants, and other stake holders to make informed decisions.

### Smart Building Technologies

The key enabling technologies of the smart buildings will be internet of things (IOT). IOT will create an intelligent, invisible network that can be sensed, programmed and controlled. IOT-enabled products will be able to communicate directly or indirectly with each other and/or the internet.

By 2020, there will be an estimated 50 billion IOT-enabled appliances and sensors deployed worldwide. These sensors will collect a wide range of data including movement of occupants, heat, light, use of space, medical emergency, intrusion, etc. Data from the sensors can be analyzed for building management systems to make reactive, anticipatory, and personalized alterations to suit the occupants.

Widespread adoption of smart sensors will require that these sensors must be incredibly cheap, consume very little power and be easy to integrate. Wireless sensors are the ideal

candidate to meet these requirements. While the costs of wireless sensors have decreased substantially in recent years, reduction of power consumption remains the biggest obstacle. Adoption of new communication protocols and energy harvesting technologies will enable their ubiquitous adoption just like wireless routers in home networking systems today.

### Benefits of Smart Building

Smart building will be able to reduce operating costs and enhance satisfaction of the building occupants. There are various ways that a smart building can save money:

- *Matching occupancy patterns to energy use* – Smart buildings will consume less energy when the number of occupants in the building is lower.
- *Optimized cooling and ventilation equipment* – The control system will provide the optimized comfort level desired by modelling the load dynamically at a minimum cost.
- *Proactive maintenance of equipment* – Using analysis algorithms, the system will detect problems in performance before they cause expensive outages, maintaining optimum efficiency throughout the entire life of the system.
- *Dynamic power consumption* – Smart buildings will ensure the lowest possible energy costs by altering usage in response to the market signals from the electricity providers.

### Conclusion

Modern buildings have become more efficient and sustainable. However, building a smart community will require implementation of smart building features in both existing and new buildings. Smart building technologies will truly transform how we live, work and play. It will reduce our carbon footprint, increase our productivity, reduce risk of physical injury, and enhance our physical well-being. Smart building technologies along with human ingenuity will be the foundation of our robust, low carbon economy of the future, ensuring a livable environment for posterity.

### References:

- [1] Smart Buildings, Royal Academy of Engineering, 2013.
- [2] A Smarter Grid with the Internet of Things, Texas Instruments White Paper, October 2013.
- [3] Smart Buildings, Francesco Asdrubali, University of Perugia, Italy, February 2013

