Topic 1
Building Services and Intelligent Building

How do buildings affect people?

- Helps us to work or carry out activities effectively
- Provide a wide range stimuli for our senses
- Enhance or dull our creativity
- Aid or hinder productivity
- Consume immense human, material and fossil fuel resources in their production and operations
- Deplete resources
- Produce pollution and waste
- Continuous and long lasting impact on the planet

What Building Services?

- Lighting and Electrical
- Water Supply
- Waste management systems
- HVAC
- Access and Security
- Fire Prevention, control and safety
- Mechanical Transport
- Communication
- Etc

- Buildings comprise of many systems designed by many people. The relationship between buildings and people can only work satisfactorily if there is integration between all the systems and the people who conceived and utilize them.
- Buildings occupy and form a major part of the environment and should affect users and passers-by positively, be it physically, mentally and spiritually.

Changes shaping our future

- Demographic
- Population size,
- life-expectancy
- Globalization
- Communications
- Global change

- Buildings create environments within them that affects peoples' mood and work performance and output

- *By 2015 the world will be predominantly urban with over half the worlds population living in cities. The number of people living in cities of over 10 million will increase to over 400 million*

Byrne (2003)

Why Intelligent Buildings?

- Environmentally conscious - green issues
- Spurred by the need to provide new infrastructure and facilities to support activities based on advances in computing and communication technologies

- Accommodate new types of work and changing lifestyles
  - Silicon chip fabrication
  - Opto-electronics laboratories for photonics and fibre optic communication and switching devices
  - Financial deregulation and the need for new dealer rooms for equipment for global electronic financial transactions
  - Control and switching centres for computer and telecommunications systems and other infrastructure eg. Control of air traffic, transportation and utilities systems

- Buildings need to be designed, engineered and constructed for new and different functions
- ICT offered the AEC industry opportunities to monitor building performances
  - Developments in climate control
  - Environmental systems
  - Access
  - Security
  - Fire detection

What are Intelligent Buildings?

- Buildings that provide a responsive, effective and supportive environment for relevant activities
- Created at the design stage but also needs intelligent operations management
- Sustainable
- Healthy
- Technologically aware
- Meet the needs of occupants and business
- Flexible and adaptable to deal with change

- *AN intelligent building is one in which the building fabric, space, servicesand information systems can respond in an efficient manner to the initial and changing demands of the owner, occupier and the environment*

Arup (2003)

- *An intelligent building is one that provides a productive and cost effective environment through optimization of its four basic elements – structure, systems, services and management – and the interrelationships between them. Intelligent buildings help building owners, property managers and occupants realize their goals in the area of cost, energy management, comfort, convenience, safety, long term flexibility and marketability.*

Caffrey (1985)

- *An intelligent building combines innovations and technology with skilful management to maximize return on investment*

  International Symposium, Toronto (1985)

- *An intelligent building is one which has an information communication network through which two or more of its services systems are automatically controlled, guided by predictions based upon a knowledge of the building and usage, maintained in an integrated database.*

  Leafer (1988)

- *The term refers to any structure designed to incorporate a combination of electronic systems for the convenience, comfort or safety of its occupants. Such systems include networks, facilities for data processing, office automation, telecommunications and building management systems.*

Lobb (1988)

- *An Intelligent building is a dynamic and responsive architecture that provides every occupant with productive, cost effective and environmentally approved conditions through a continuous interaction among its four basic elements: places)fabric,; structure; facilities); processes)automation; control; systems); people (services; users); and management (maintenance; performance) and the interrelations between them.*

  CIB working Group W098 (1995)

- *An intelligent building is one that provides a responsive, effective and supportive intelligent environment within which the organization can achieve its business objectives.*

  DEGW/Teknibank (1992)

- *High performance green buildings are energy and resource efficient, non-wasteful and non-polluting, highly flexible and adaptable for long term functionality, they are easy to operate and maintain, and are supportive of the productivity and well-being of the occupants.*

Traugott(1999)

From the point of view of users, there are four fundamentally important areas:

- Aesthetics
- The senses
- Convenience
- Whole Life Values.

Some characteristics of Intelligent Buildings

- Naturally responsive buildings with the discriminate use of appropriate high technology interactive systems.
- Low environmental impacts on external and internal environments
- Sustainable water and waste systems
- Healthy environments
- Low energy consumption
- Good management

- With the rapid development of technology it is easy for buildings to be stuffed with complex and complicated equipment to operate systems. Achieving simplicity involves a period of acquiring understanding and during this time formulating solutions is difficult. The result is often overcomplicated solutions. As we gain a deeper understanding about intelligent buildings it will be easier to achieve solutions characterized by simplicity in operations.

Future Visions

- Buildings will be largely shaped by value for money water conservation, occupant well being, health, productivity, renewable energy and energy effectiveness.

- The following technological issues are important:
  - Embedded sensors and automatic controllers allowing buildings and other inanimate objects to have intelligence
  - Biomimetics and biotechnology as major forces in developing new materials
  - Nanotechnology affecting new materials, processes and inventions – new materials, processes and inventions – revolutionizing health, eliminate pollution, provide super intelligence and super resource efficiency

  - Energy production and related new technologies which are more sustainable
  - Chip implants for direct transfer of electronic information
  - ICT allowing greater virtual interaction, virtual modeling and e-business
- The future drivers for intelligent buildings are likely to be ICTs, robotics, smart materials, sustainable issues technologies and social change.

Integration

- Since the 1980's when services were individually monitored, multifunctional devices have been developed plus recently computerized systems.

- Gann (1999) classified the development of enhanced communications networks as:
- Human Flows: supervision and private entry ways
- Energy and water flows: monitoring of networks and calculation of energy and water, management of networks and calculations of energy and water in each residence, waste management system.
- Information flows: managing the transmissions and reception of messages between residents, facilities management team and certain outside services such as police, fire, schools, hospitals and GP surgeries.

- The potential application areas include
- general comfort and safety
- dealing with mobility difficulties
- cleaning and routine maintenance
- memory joggers
- learning
- age related changes such as reduced vision and hearing

Figure 1.1 represents the integration of the various components of the intelligent buildings.

Networks

- Building management systems rely on networks that connect pieces of equipment in various systems that operate the building, There are common open communication standards and protocols that are evolving for this purpose such as BACnet : Building Automation and Controls Network and BACnet/IP

References:

- Clements-Croome D. (ed) (2006), **Intelligent Buildings: Design, Management and Operations**, Thomas Telford Publishing, London
- Burberry, P. (1997), **Environment and Services**, Addison Wesley Longman, Harlow.