Investigating the Performance of Smart Buildings and Intelligent Building Management System (BMS)

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Abstract

Increasing daily energy consumption, and on the other hand the depletion of its resources have led successors and energy consumers to look for ways. This paper presents the applications of technological advances and new technologies in the field of building is intelligence and energy consumption management in buildings. The use of this technology, in addition to reducing energy consumption, creates appropriate and ideal conditions and increases the comfort of the building's occupants.

Key Words: Smart Building, Make Smart, New Technology, Energy consumption management.

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1.0 Introduction

In the year of 1988 an architect named Atkin for the first time defined the smart buildings, and he said; A smart building is aware of what is happening inside and outside of it, and can deal with these events and to create Bring a interesting environment for its users to make the most effective and best decisions at a particular time, in addition to the ability to obtain input information and the ability to respond to the output, Atkin also added the factor of time to his definition [1]. According to this definition, all system decisions in dealing with events inside and outside the building must be made at their own time, and if these decisions are made at another time, it will not be valuable. The word (informed) in the definition of Atkin means the information received and the tools of communication by which the information is entered and collected in the control system. The word (decides) in this definition means all kinds of answers; Like the decision of the system to balance the temperature inside the building, Coordinate building form, all of these are called system output [2-3].

In this research, we discuss these features to clarify the contribution and role of each in smart buildings. In general, a smart building is a building that is equipped with a strong communication infrastructure that can continuously react to and adapt to changing environment systems and still allow building occupants to Use available resources more effectively, increase their security and tranquility. The concept of smart building represents the type of exchange and strong exchange

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of information between different parts of the building without violation. The term (building sections) includes all the components that play a role in the management of the building. Sections such as (Hvac), mechanical, construction, access control, security, management, lighting, maintenance, energy management networks [4-5]. Intelligent building, that is, the control and management of the components of a building by users who use computer capabilities to meet the needs, the unique feature of this technology is to create coordination and integration between all systems that have been used individually so far. And thus allows for a wide range of design, installation and use. One of the main benefits of this technology, besides creating more convenience and security, is energy saving [6-7].

2.0 Building Management System (BMS)

BMS or Building Management System consists of two parts, software and hardware; Hardware is usually implemented specifically by microcontrollers, and software may be design and coded specifically for the system. Some systems use control and monitoring software to control and monitor the performance of various components of the building [8-10]. The function of this complex is to continuously monitor the disturbed parts of the building and to apply in a way that the performance of the disturbed components of the building is balanced with each other and in optimal conditions, Reduction of additional costs and create a pleasant and safe environment [11]. In other words, a building management system is a system that monitors the activities and affairs of buildings and, when necessary, automatically applies the necessary changes due to differences in environmental conditions [12-13]. This system can be designed and implemented with regard to the use of the buildings (residential, office, commercial, hospital ...) and on all activities including opening and closing the door, entry and exit of people, lighting systems, air conditioning systems or ventlization, Monitor windows and curtains of rooms, audio and video, etc. A building that is equipped with a BMS management system is called a smart building. This system allows the residents to use the equipment more efficiently and increase the feeling of security and comforta in them, and can also save energy[14-15]. These buildings use the integration of the four main elements of systems, structures,. Service and management and create a dynamic and cost-effective environment by communicating between them [16].
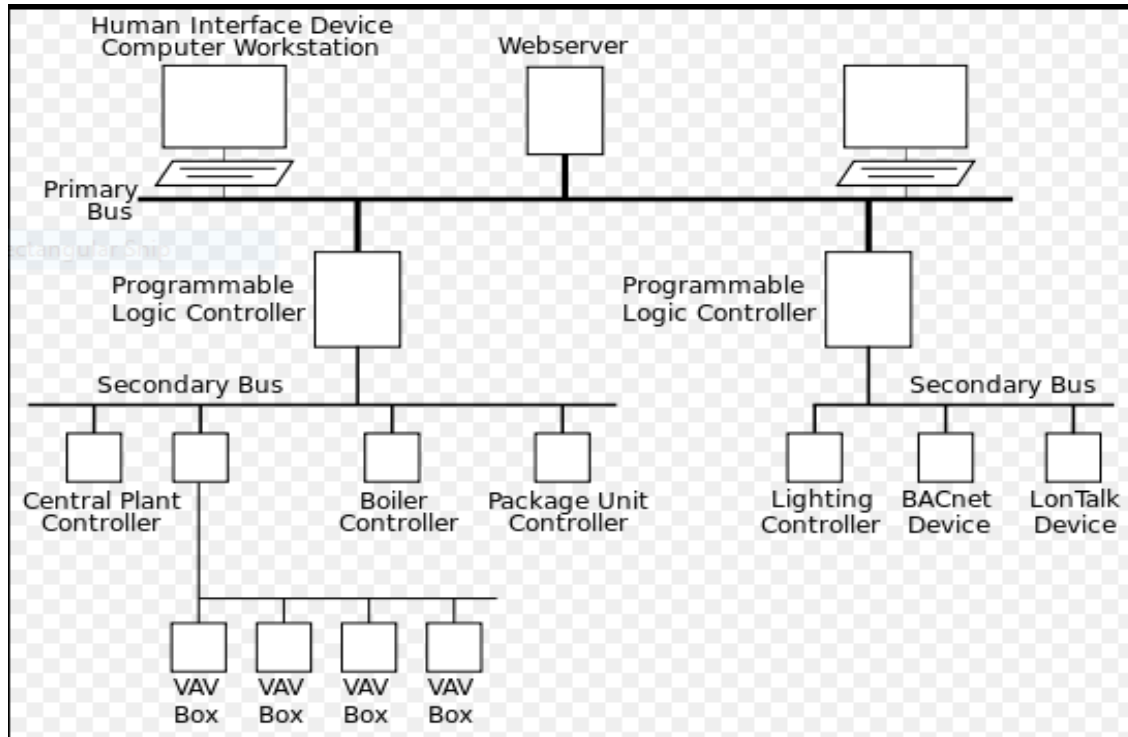
Figure 1 Smart building equipment

2.1 Benefits of using BMS system

The main advantages of the BMS system can be divided into the following three main axes:

1.0 Energy saving and maintenance costs: Studies have shown that using an intelligent system reduces energy consumption and running costs by an average of 20%. In addition to reducing energy consumption, turning off and controlling this system reduces depreciation, increases the life of devices and reduces related costs.

2.0 Safety: In critical situations, by sending an explicit and timely warning, it can play an effective role in preventing accidents and reducing its effects, and automatically sending emergency messages to the competent persons or organs [17]. Also, controlling the door and entry points and connecting it to CCTV cameras and entry recording devices can significantly increase system security.

3.0 Increase the level of comfort and convenience: This system can intelligently perform many repetitive tasks and inspections required, for example, in the presence of people to turn on the lighting and fan coil, or increased irrigation of greenery and garden Automatically perform the predefined modes with the push of a button, or adjust the temperature, light and humidity of the places to the desired level.

2.2 Using BIM

There are two main ways to use BIM:

1. Central denominator method

In the central repository method, it is assumed that all project information is stored in a single database file. for example; All project scheduling and financing information will be added to their 3D model information. This method is not very reasonable and practical; Because the type of information required by the designer is different from that of the contractor, while the designer is involved in issues such as examining the building's energy consumption and applying regulations and designing spaces, the contractor is interested in scheduling work and estimating costs. Therefore, in order for the estimation work to begin, the designer's work must be completed, which is not practical, at least in the early stages of the work [18].

2. Extensive tank method

Extensive repository method is the method used by most designers and contractors, in which the BIM model accesses separate data generated by standalone applications after going through the databases, e.g. All the information needed to estimate the project is in the relevant independent program, which needs a two-way communication with the three-dimensional BIM model to do its job, in order to exchange the necessary information. This is possible in the very early stages of design. Therefore, despite the use of independent data sources due to the property called (Interoperability) all the information of different groups involved in the project are integrated [19].

Thus design groups include; Architecture, structures, electrical and mechanical installations, their models separately in software such as; (Autodesk Revit) and finally with the help of software such as; (Autodesk Navisworks) is assembled to obtain an integrated BIM model.

The purpose of this research is to apply the smart building technology at residencial, office and commercial building to reduce energy and safe environment sources, and also to facilitate for house onwers and think of their comfortabilities. This is a library research.

3.0 Advantages of using BMS

1. Increase safety and security: fire alarm and extinguishing system, surveillance system, CCTV images and eavesdropping system, the possibility of networking the presence of alarm and anti-theft systems, control systems for entrances, exits, locks and defining the access level for the department. Different buildings.

2. Facilitate building management: Building management system integration of the above infrastructure and establishing a logical connection between system components, emergency power distribution, system for receiving information on consumption and performance of different parts of the building for appropriate decisions, possibility of changing energy distribution and facilities in time Special situations and critical situations are presented as examples of application of intelligent system features [20].

3. Remote control: You can use the phone or the Internet to create an image of the interior of the building and control all systems

4. Lighting control: According to the statistics of the Optimization Organization, more than 40% of the electrical energy input of the building is consumed in lighting fixtures. While usually not enough light is produced

5. Security and safety control: In this system, the security control function manages all the channels related to security devices and regulates the danger channels.

6. Resident presence simulation: During residents' absence, windows open and close normally and lamps and sound systems such as; When people are present, they turn on and off so that thieves and assailants are not informed that the building is empty.

7. Fire alarm and extinguishing: smoke or heat dedectors are set up with indoor electrical systems. In fact, indoor systems are programmed like interconnected chains against potential hazards, and in addition, security measures are taken at the appropriate time. That the damage has not yet caused the destruction of the building, is used.[8]

8. Technical warnings: The smart building manages technical messages. Therefore, residents are informed of damage to water systems or electrical circuits in a timely manner and prevent further problems.

4.0 How to access and control facilities in a smart building

4.1 Central control panel

With a central control panel, it is possible to intelligently control all the devices in the building and be aware of their operation status. The screen is equipped with touch technology that adds to its ease of use and does not require any other input to use.

4.2 Control using radio waves

With this technology, it is possible to control the smart building wirelessly, the control device can be a PDA, Tablet PC or a simple radio remote control. The main advantage of using RF to IRDA (technology used in TV controls) is the operation of long distances and no need for direct vision[9]

4.3 Remote control

The smart building allows you to stay up to date and control the building remotely. You can take advantage of this possibility by using an IVR SMS or via the Internet

4.4 Automation

The smart building takes control of some of the day-to-day and repetitive tasks to make it easier for you and brings you more comfort. The automatic operation of the system can include pre-determined tasks or by using temperature, light, wind, rain sensors, humidity sensors and person presence detection sensors, etc., it can adjust the conditions optimally or announce the necessary warnings.

5.0 Features of building management systems

Building management systems used to be implemented for economic reasons only in large buildings with extensive mechanical, electrical and plumbing systems, but today this system can be used in all buildings.[10] Perhaps one of the most important reasons for BMS systems to be economically viable is energy savings. The additional cost of water, electricity, gas, telephone, etc., and the need to save more on these items, requires an intelligent control system. A system that can:[10]

1. Control the temperature of the rooms and water heaters and different parts of the building (heater or air conditioner should be turned on and off according to the temperature, setting).

2. Turn off the unused light bulbs.

3. Be warned to open and close doors and windows in hot and cold seasons.

4. Power outage of unused appliances.

5. It is not possible to use high-consumption appliances during peak times. (Or the duration of use of a device such as a phone is limited).

6. Brightness control with automatic voltage reducers.

7. The possibility of using intelligent systems, lighting control to create special lighting.

8. Control the keys by remote control

5.1 Equipment that can be controlled via BMS

1. Lighting Using the BMS system, the lighting of different parts of the building can be made intelligent. Brightness control includes turning on and off their automatics, adjusting the light level, decreasing or increasing them, as well as determining and observing their status and the possibility of turning them on and off remotely or outside the building. [9]

2. Protection and security systems: Fire alarm and extinguishing systems for personnel entry and exit, CCTV camera and water leakage and flooding and electric shock protection can also be connected to the BMS system and controlled by it.

3. Doors, windows, curtains and awnings: Using the BMS system, these equipments can be controlled and their status can be observed and the necessary commands can be issued in this regard, and it can even be done using a fingerprint sensor or card. In addition to providing security, Magnetism also applied more with the possibility of classification and access scheduling.

4. Heating and cooling systems (air conditioning), cooling and heating systems can include central equipment and indoor equipment. Central equipment located in the engine room, such as; Chillers, other spas, system pumps, cooling towers, etc., and local equipment such as; They are fan coils, window air conditioners and air conditioners. Through the BMS system, the central equipment can be turned on and off at specific times and remotely, and also, with the change of environmental conditions, the necessary changes can be applied, and also, this system can

intelligently control the temperature of the rooms. And in the absence of people to turn off the equipment.

5. Audio, video systems and office equipment: Using the BMS system, it is possible to select a central audio archive, or to select and execute predefined modes for different ceremonies, or office equipment. Controlled through this system.

6. Video system of entry and exit of guests or clients: In the case of office buildings, this system can record the entry and exit of all guests and even record their image, and in residential buildings, it is possible to receive the image of the client on the screen and In case of absence of image recording, along with the time of visit, and even if there is internet, it is possible to communicate with the guest remotely.[8.9]

7. Control of pool, sauna and Jacuzzi facilities: This system can intelligently turn this equipment on and off and control the temperature purifiers and other necessary controllers.

8. Communication systems: Support for telephone lines, messenger, telephone center is also a feature of this system.

9. Irrigation system: Irrigation of plants in the environment or inside the building should be done automatically according to a predetermined plan, so using the building management system, buildings can be made up to the desired level and the cost of this work is closed. The level of intelligence can be very different but it is possible.

6.0 Limitation

In general, scientific research is not out of the question. Therefore, the present study has the following challenges:

1. Lack of sufficient time for scientific research;

2. No previous record of access to scientific research;

3. No general access to smart buildings ;

7.0 Result

Since the costs associated with maintenance and repair during the useful life of the building make up a significant share of the building costs, the intelligent building management system, due to its important role in reducing these costs, causes a return on investment. Do it at a reasonable time. Another effective factor in the return on initial capital spent on setting up and installing an intelligent building system is to reduce energy consumption and consequently reduce costs.[13] Among the parameters that are effective in reducing consumption, the following can be mentioned:

1. Planning for the start and end of the facility: for example; The cooling and heating system and the lighting system of office buildings can be switched off or off at minimum energy consumption during non-staff hours or on holidays.

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2. Use alternative sources at the right time: for example; When the outside temperature is favorable, the heating and cooling system should be turned off, and as much light as possible can be provided from outside the building.

3. Reduce operating, maintenance and repair costs of the building: The payback time is usually between two to four years, but this time will vary depending on the type of intelligent system used in the building. for example; If an intelligent system is used, the engine room will have a return on investment of about twelve months. If the intelligent building system is used, energy consumption will be reduced by more than 15%. This value varies in different parts of the system, e.g. By using the intelligent engine room system in this section, up to forty percent of consumption savings are done.

8.0 Recommendation

The following topics are suggested topics for the development and continuation of the present research:

1.Investigating the Challenges and Requirements of Using Building management system

2. How much is building management system important at development countries

3. What are the obstacles for using BMS at pour countries

9.0 Conclusion

The main philosophy of smart building technology is based on focusing on the user and his needs, and responds to current and future requests in a simple and appropriate way and has the ability to adapt to future technologies. Thus, a smart building is a building that has the ability to respond (output) to the needs of its users based on information processed by multiple inputs. Timely response factor is very important and necessary in this building, multiple receivers and transmitters receive information according to their monitoring of changes in indoor and outdoor environment, also do not forget that one of the main components A smart building is the ability to learn. Before building a smart building, system planning is very important to know well the goals you want to give it, the real need to have a smart building can be clearly revealed on the results and now they meet this need by building this building Will be fixed or not.

for example; Productivity is one of the necessities of companies, the internal environment of an office determines many factors for the productivity of an employee. Therefore, the need to use BMS will become more prominent in the near future. In addition, due to the depletion of energy resources and the devastating effects of excessive consumption on the environment, it is possible to keep pace with the global community by using new technologies to reduce energy consumption.

In addition to its role in optimizing energy consumption, the intelligent building system also brings comfort and well-being, and it can be hoped that in today's busy and modern life, it will be a suitable solution to create more comfort and speed up daily affairs

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