IMPLEMENTATION OF INTELLIGENT BUILDING SYSTEM IN COMMERCIAL BUILDING

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Abstract -The definitions of an intelligent building system is systemically classified by the information and control services that serve the needs and expectations of the occupants. Intelligent Building System (IBS) has the ability to monitor and control various facilities within the building so as to offer its users or occupants with effective security, improved productivity, human comfort, and efficient energy management.This intelligent system provide Ambient Assisted Living (AAL).The social and economic impact of AAL systems have boosted the research activities that combined with the advantages of enabling technologies such as Wireless Sensor Networks (WSNs) and Internet of Things (IoT) can greatly improve the performance and the efficiency of such systems. Sensors and actuators inside buildings can create an intelligent sensing environments that help gather real time data for the users. The main IBS subsystems include Heat, Ventilation and Air Conditioning (HVAC), Lighting Systems, Life and Safety System, and Access Control. This thesis focuses on the design implementation and development of HVAC and lighting controllers. Intelligent buildings need to receive, analyze, and react according to such processes, responsive ones are required only to receive and react to only one input parameter. Receiving, analyzing, and reacting are the key criteria of intelligent building

Keywords— Building automation system, Intelligent building, Sensors, Building management system.

INTRODUCTION

Intelligent building concept is a new but has been prolonging from 1970. This concept utilizes the optimized performance of the plant and equipment. These utility items make use of automated system and controls. Intelligent buildings were first advocated by UTBS (United technology building system) corporation in United State of America (USA) in 1981 and became a reality in 1983 with the inauguration of the city place building in Harford, Connecticut, USA. The Harford building was advertised as the world first intelligent building. The ultimate dream in the design of intelligent building has always been to integrate the four main operating areas: building structure, building services, building systems and building management to the satisfaction of the occupants and building owners in terms of cost, comfort, convenience, safety, long-term flexibility and marketability. According to the concept of intelligent building or intelligent homes, or building management system (BMS) embraces several technologies, spanning institutional, domestic, commercial, industrial building control and management systems. The building management system is central to intelligent building management services like lighting, heating, security, closed circuit television (CCTV) access control, entertainment systems, audio visual, climate control, ventilation and filtration.

REVIEW OF LITERATURES

A. Overview of intelligent architecture

Concept of intelligent building presents the strongest level of communication among a building's systems. Building systems refers to all systems that operate a building like HVAC, mechanical, structural, access control, safety and security, building management, lighting, maintenance, local networking, and energy management. Accordingly to his paper by which the building can be considered as intelligent when it have input system that receives information by means of information receiver and Processing them and providing information analysis. Output system that reacts to the input in form of a response and the time consideration that makes the response happen within the needed time.

B. A study on intelligent building management system

IBMS is to centralize the monitoring, controlling operations with innovations, technological or not, and skillful management of facilities within the building to achieve more efficient building operations at reduced energy and labor costs while providing a safe and quality working environment to the occupants. The following functions can be achieved through IBMS are Automatic Monitoring of Parameters, Automatic Integration of Information, Automatic Control of Facilities, Remote Single Point Supervision And Surveillance, Event Actuated And Time *a*ctuated Report Generation, Self - Diagnostics of Processes And Systems, Provision for Enhancement and energy Saving And Reduction In Operating Cost Due To Automation and Close Monitoring and Operation.

DEFINITION OF INTELLIGENT BUILDING

A. *Definition of intelligent building by intelligent building institute*

The first definition, coined by the intelligent buildings institute, defines an intelligent building as "one which provides a productive and cost-effective environment through optimization of four basic elements: structure, systems, services and management, and the interrelationship between them.**"** According to this initial definition, an intelligent building is one that optimally matches its four elements **to** the users' needs with an emphasis on the technology that makes the interrelationship between the elements possible.

B. *Definition of intelligent building in India*

According to Telecommunications Consultants India Ltd *(*TCIL), An Intelligent Building provides a productive, cost effective environment through optimization of structure, systems, services and management as well as inter-relationship between them.

METHODOLOGY

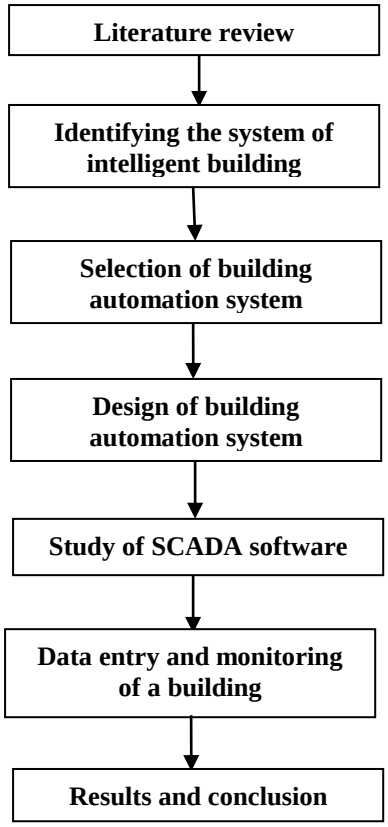

Fig.1 Methodology

SYSTEM IN INTELLIGENT BUILDING

A building is said to be intelligent, if they receive, analyze, and react according to processes, responsive ones are required only to receive and react to only one input parameter. Technology and communication systems make it possible to combine several parameters by using system integration and computerization. Technology and computerized systems have enhanced and changed the manner of responses and provided a variety of decisions according to different sources of information. So, to carry out this process two systems are mandatorily required they are,

1. Building automation system (BAS)
2. Intelligent building management system (IBMS)

A. Building automation system

The term "building automation systems" refers to all systems that operate a building like HVAC, mechanical, structural, access control, safety and security, building management, lighting, maintenance, local networking, and energy management. In addition to the learning ability, information transferred between systems should be processed and analyzed in Building Control System (BCS) that woks as building brain. The goal should be reaching to an optimum solution.

Accordingly, the basic criteria by which the building needs to have to be considered as intelligent are:

1. Input system that receives information by means of information receiver.
2. Processing and information analysis
3. Output system that reacts to the input in form of a response.
4. Time consideration that makes the response happen within the needed time.
5. Learning ability

B. Intelligent building management system

The objective of the IBMS is to centralize the monitoring, controlling operations with innovations, technological or not, and skillful management of facilities within the building to achieve more efficient building operations at reduced energy and labor costs while providing a safe and quality working environment to the occupants.

An Intelligent Building provides a productive and cost effective environment. It integrates its various facilities and systems to effectively manage resources in a coordinated mode to maximize –

i. Occupant protection
ii. Energy and operative cost savings
iii. Flexibility in adapting to changes

It is one that provides a comfortable, productive and cost effective environment through a comfortable, productive and cost effective environment through optimization based on three elements: people (owner, builder and occupants), products (materials, structure, facilities, services etc.) and processes (automation, control systems maintenance, performance etc. and interrelations between them.

DESIGN OF BUILDING AUTOMATION SYSTEM

Building automation is the automatic centralized control of a building's heating, ventilation and air conditioning, lighting and other systems through a Building Management System or Building Automation System (BAS).

A. Parking control system

Real time parking space availability is detected by light dependent sensor. Smart parking uses sensors, wireless communication technology, data analytics etc.

to solve parking issues. Smart parking solutions can be used to locate available parking space with the help of sensors. This saves customer's time as well as minimizes wastage of fuel.

When the car arrives the information of car is received using RFID technology, the check in and checkout time for the vehicle can be reduced and also the payment system can be automated. Similarly using wireless sensors information like parking duration, available slot, billing details, directional details etc. can be obtained which will help the drivers and will thus ease out parking vows. Light dependent sensor is mounted in surface of each bay to detect whether the space is available or not.

The real time space availability is decided by presence or absence of light

Presence of light – Availability of parking space

Absence of light – No Availability of parking space

Fig.2 Surface mounted light dependent sensor

B. Lighting control system

Real Occupancy Control Strategy limits the operation time of the lighting system based on the occupancy time of a space. It does not operate by a pre-established time schedule. The system detects when the room is occupied and then turns the lights on. If the system does not detect any activity in the room, it considers the room as unoccupied and turns the lights off. To prevent the system from turning the lights off while the space is still occupied, a delay time (ranging typically from 10 to 15 minutes) can be programmed. Real Occupancy Control Strategies are best used in applications where occupancy does not follow a set schedule and is not predictable. Each dial have their own control settings, first dial – Time dial, Second dial – Range dial and Third dial – Light sensitivity dial.

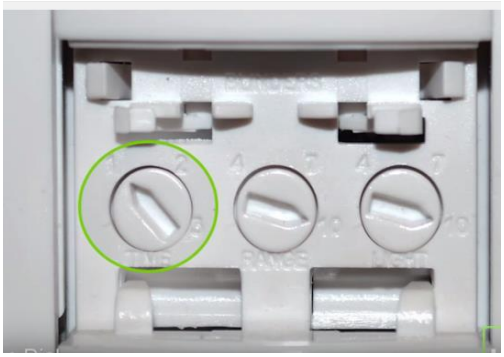

Fig.3 Ocuupancy sensor and its settings

C. Security control system

Control system security is the prevention of intentional or unintentional interference with the proper operation of industrial automation and control systems. These control systems manage essential services including electricity, petroleum production, water, transportation, manufacturing, and communications. They rely on computers, networks, operating systems, applications, and programmable controllers, each of which could contain security vulnerabilities. Each dial have their own control settings, First dial – Time dial and Second dial – Light dial.

Fig.4 Motion sensor and its settings

D. Fire protection system

Fire protection systems are used to extinguish or prevent the spread of fire in a building or vehicle. Protection systems use a combination of dry chemicals and/or wet agents to suppress equipment fires. When the surrounding temperature exceeds the design temperature of the liquid in the glass bead then the liquid in the bead tends to expands and in turn it breaks the glass bead and automatically water is sprayed There is no delay in time that water is put on the fire

Fig.5 Colour of sprinkler heads

E. Heat ventilation air-conditioning

Heating, ventilation and air conditioning (HVAC) is the technology of indoor and vehicular environmental comfort. Its goal is to provide thermal comfort and acceptable indoor air quality. HVAC system design is a sub discipline of mechanical engineering, based on the principles of thermodynamics, fluid mechanics, and heat

transfer. Each dial have their own control settings, Top dial – Sensitivity, Left dial – Timing and Right dial – Humidity

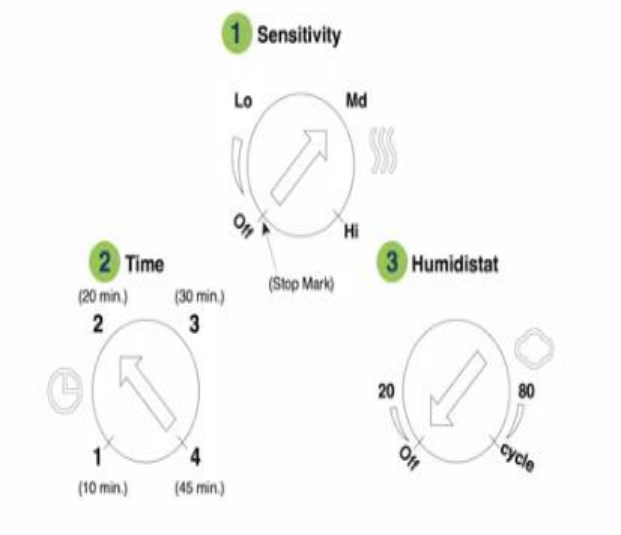

Fig.6 Humidity sensor settings

IMPLEMENTING BUILDING MANAGEMENT SYSTEM USING SCADA

Supervisory control and data acquisition (SCADA) is a control system architecture that uses computers, networked data communications and graphical user interfaces for high-level process supervisory management, but uses other peripheral devices such as programmable logic controllers and discrete PID controllers to interface to the process plant or machinery. The operator interfaces which enable monitoring and the issuing of process commands, such as controller set point changes, are handled through the SCADA supervisory computer system.

Initially, the building wing should be added in the citect scada. These building part should be made active for its function. Report can be obtained only for active building. Each and every day it should be made active for its operation.

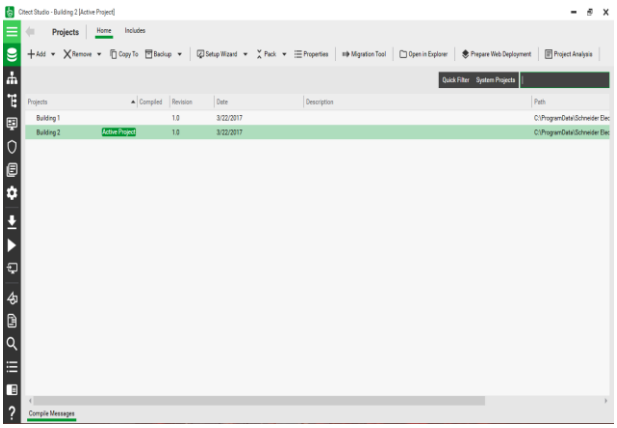

Fig.7 Building wing

The building to be monitored is divided into part. To make the process ease.

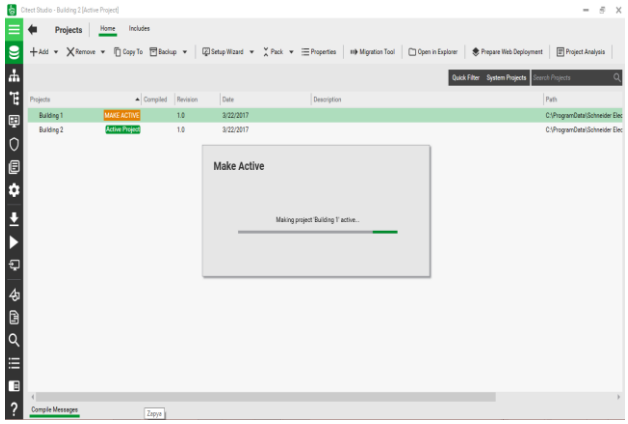

Fig.8 Make building active

For the monitoring process, initially building should be made active daily and the same is deactivated if the GUI is closed i.e., it is activated according to office hours.

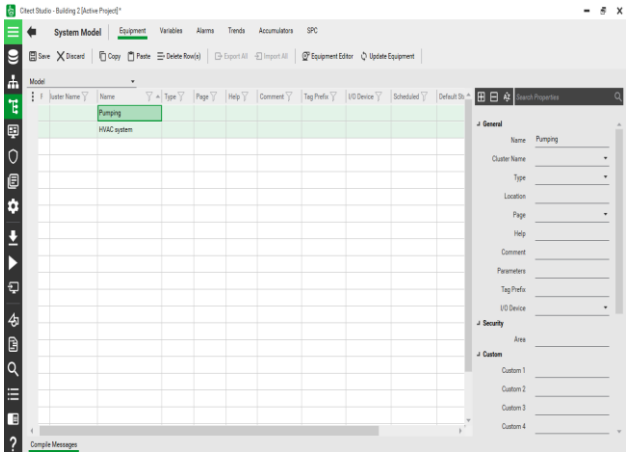

Fig.9 Equipment model

Equipment model means the equipment used in the building and to be monitored is added. It includes only the equipment used for comfort and do not include equipment like machines.

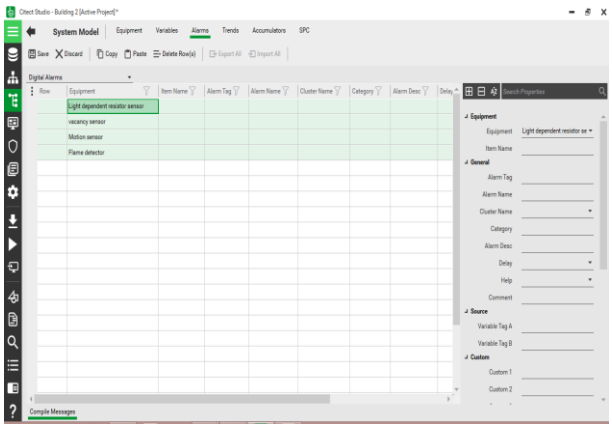

Fig.10 Sensors

Building automation system needs sensor for their operation. Hence, sensor used in the building should be added. So that their opeartion can be monitored.

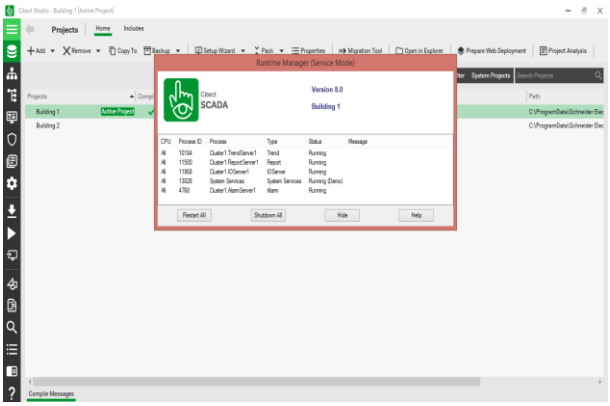

Fig.11 Run the building

After adding all the necessary details in the GUI. To obtain the report the building should be undergo run project. If any errors in data entry of the building the run process will be freezed.

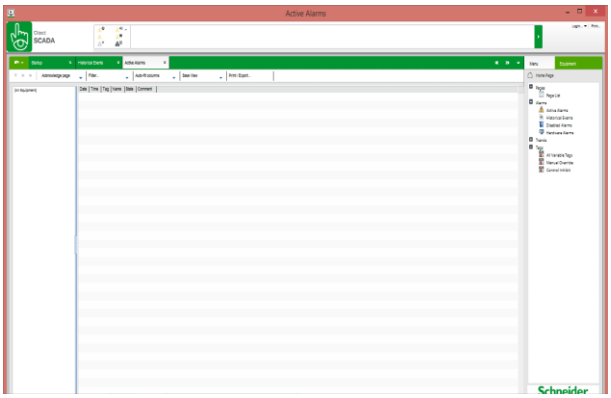

Fig.12 Control over the building

To have an extreme control over the building. GUI is formed after the run process. The active and non-active alarms is displayed. If any alarms are non-active then necessary measures should be made physically.

CONCLUSION

This project topic was specially selected because in recent year's automation of a building is widely asked by the clients. From the studies, it was realized that when the structural designers were not initially given the full requirements and understanding of IBMS and BAS, the structural forms may not be suitable for the implementation of these systems. An example would be the failure to provide an adequate and proper control room as shown in the earlier chapter of a typical control room. Another example would be the required space for conceal piping for wiring and cabling. It is common knowledge that many intelligent building did not have adequate follow-up actions as in energy consumption monthly and annual auditing and maintenance programmes. A good intelligent building will lose its efficiency through aging and lack of maintenance. Sometimes, this lack of auditing and follow-up actions was due to staff turnover and also lack of leadership and ownership of the manager in training the new staff. The cost of implementing the IBMS and BAS sometimes put off owners when they face shortage of fund even though they realized the benefit of these systems.

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