Performance of Year Round Air-conditioning on a Super Market

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Abstract— The Heating, Ventilation and Air Conditioning (HVAC) system is arguably the, most complex system installed in the building and is responsible for a substantial component of the total building energy use. Maintaining optimal temperature and air circulation are the basis of a comfortable indoor environment .This role is played by HVAC (Heating, Ventilation and Air Conditioning) systems. Due to the Increase and Decrease of the customers regularly to the shop the Hot Air is carried out of the shop with the help of Year round Air Conditioning Unit. The layout of a super market is made by Autodesk REVIT software. A Complete air conditioning system was designed to control the temperature, relative humidity, air movement etc. In this project calculations were done by using the Revit air conditioning software. After taking the plan, heating and cooling load calculations values were taken by the design department. The same values will be used in the Revit software at human comfort condition to get temperatures DBT, WBT and MEAN RANGE VALUE.

Keywords: DBT, WBT, Mean Range Value

I. INTRODUCTION

A modern building has a numerous requirements. Fresh air, Cooling and heating play an important role in designing and managing a building. An HVAC (Heat, Ventilation and Air conditioning) systems are provided so as to meet the requirements of comfort, cost, efficiency and aesthetic appeal. A sustainable system adds to the complexity of designing an HVAC system[1]. The energy consumption by buildings must be reduced without compromising in the services provided by the building in a sustainable way, thus ensuring a comfortable indoor climate for the people. The major aspect of setting the energy goals should be HVAC system. The most efficient way of lowering the energy consumption is by improving the energy efficiency. The cooling needs in a building are increasing day by day to provide a comfortable indoor environment because of the extreme weather conditions and types. A favourable strategy for sustainable cooling is by using large surface at relatively high temperatures for radiant cooling system. This can be used for both heating and cooling the surfaces which provides a comfortable ambiance. Radiant cooling systems Radiant cooling systems are temperature-controlled surfaces that exchange heat with their surrounding environment through convection and radiation that can be provided in spaces where the cooling load during day time is higher[2]. Radiant cooling offers optimal operating conditions for integration of renewable energy and free cooling. Basically in a Sustainable HVAC system the main focus is on management of waste and pollutants which can extend up to the material of the equipments and the wellbeing of the staff. The installation cost of an HVAC system can be attained by 30% cutting down of yearly energy cost and can be regained within a few years when the building gains conventional comfort. By providing natural ventilation and air movements the savings can be improved.

II. LITERATURE SURVEY

Jordi Serra, David Pubill, Angelos Antonopoulos Concluded on his paper on Smart HVAC Control in IoT: Energy Consumption Minimization with User Comfort Constraints that Smart grid is one of the main applications of the Internet of Things (IoT) paradigm. Within this context, this paper addresses the efficient energy consumption management of heating, ventilation, and air conditioning (HVAC) systems in smart grids with variable energy price. To that end, first, we propose an energy scheduling method that minimizes the energy consumption cost for a particular time interval, taking into account the energy price and a set of comfort constraints, that is, a range of temperatures according to user's preferences for a given room. Then, we propose an energy scheduler where the user may select to relax the temperature constraints to save more energy. Moreover, thanks to the IoT paradigm, the user may interact remotely with the HVAC control system. In particular, the user may decide remotely the temperature of comfort, while the temperature and energy consumption information is sent through Internet and displayed at the end user's device. The proposed algorithms have been implemented in a real testbed, highlighting the potential gains that can be achieved in terms of both energy and cost.

This paper has dealt with the energy consumption management of HVACs, for a given smart pricing tariff and users' comfort constraints. Moreover, the integration within the IoT framework has been studied.

Raad Z. Homod has conducted an experiment on Review on the HVAC System Modeling Types and the Shortcomings of Their Application. Here we observed that in late the commercial and residential buildings are facing a new era of a growing demand for intelligent buildings worldwide. Intelligent buildings are referred to as energy and water saving, and they provide healthy environment. The first intelligent building was introduced in the late 1970s when buildings were equipped with IT equipments. The developments of the improved building and AHU models are essential to meet the requirements of an intelligent building. The HVAC system modeling evolution of research has been reflected on the representation of the indoor thermal behavior by development and enhancement of identification of buildings and AHU equipments. In general, research on indoor thermal comfort can be divided into two main categories: design-oriented research and research-oriented design as explained by Fallman .This study followed the second category where it depends on the previous research outcomes to develop a design that enhances the indoor thermal comfort.

Major disturbance is solar radiation which is very hard to modes correctly.

Qiaoxia Yang (2014) concluded on the paper Impact Analysis of Window-Wall Ratio on Heating and Cooling Energy Consumption of Residential Buildings in Hot Summer and Cold Winter Zone in China. This paper presents and study of China's topography is varied and complicated. Because of the different geographical conditions, climate in different zone has great disparity. In order to meet the different requirements on building in different climate conditions, China was divided into severe cold zone, cold zone, hot summer and cold winter zone, hot summer and warm winter zone, and temperate zone from the perspective of building thermal design. In order to assess the optimal window-wall ratio and the proper glazing type in different air conditioning system operation modes of residential buildings for each orientation in hot summer and cold winter zone, model in three typical cities Chongqing, Shanghai, and Wuhan is built and analyzed.

The influence & sensitivity of window-wall ratio on total energy related to operation mode of air conditioning system.

Jing-Nang Lee (2014) conducted on his paper Modeling Validation and Control Analysis for Controlled Temperature and Humidity of Air Conditioning System. Here we observed that how the energy base model of thermal system for Controlled temperature and Humdity of Air Conditioning System is done by using a thermal model in MATLAB dynamic simulation. The PID control strategy is applied for controlling the air mass flow rate, humidifying capacity, and heating, capacity. The results prove that the proposed system is an effective controlled temperature and humidity of an air conditioning system.

The distribution of temperature & humidity stable at 541 secs. error only 75% Maintain Indoor air quality is fortable & safer environment.

Grigore Stamatescu et al Concluded in his paper entitled "Data-Driven Modelling of Smart Building Ventilation Subsystem" that "The Management and Automation of a Commercial building Heating, Ventilation and Air Conditioning (HVAC) System. This has got enormous benefits from the use of all the available information sources. The modern HVAC using direct digital control methods have provided useful performance data from the building occupants. Buildings have become major drivers of energy consumption and quality of life challenges in the modern, urbanised, society. As the potential impact of implementing advanced sensing, computing, and communication is steadily realised, they have also become smart. In a technical context, we view and define smartness by having the building comply to the dual objectives of occupant awareness and energy efficiency, achieved by modelling, simulation, and control over the network of field devices and controllers. This leads to increased requirements on the control strategies to balance in an online manner the needs of the building users for comfort with the needs of the building operator for reduced costs.

Particular application of data mining method to data collected from the ventilation subsystem of the smart building.

III. METHODOLOGY

A. Process Involved In Methodology

Autodesk Revit is building information modelling software for architects, landscape architects, structural engineers, mechanical, electrical, and plumbing (MEP) engineers, designers and contractors. The original software was developed by Charles River Software, founded in 1997, renamed Revit Technology Corporation in 2000, and acquired by Autodesk in 2002. The software allows users to design a building and structure and its components in 3D, annotate the model with 2D drafting elements, and access building information from the building model's database.

Charles River Software was founded in Newton, Massachusetts, on October 31, 1997, by Leonid Raiz and Irwin Jungreis, key developers of PTC's Pro/Engineer software for mechanical design, with the intent of bringing the power of parametric modeling to the building industry (PTC had previously tried and failed to market its recently acquired Reflex software to the construction sector) [3].

B. Create a project

In the drawing area, under Projects, click New.
In the New Project dialog, under Create New, verify that Project is selected.
Under Template file, verify the second option is selected, and click Browse.
In the left pane of the Choose Template dialog, click Training Files, and open \Imperial\Templates [Metric\Templates].
Select default.rte [DefaultMetric.rte], and click Open.
In the New Project dialog, click OK.
Name and save the project file
Click File menu ➤ Save.
In the left pane of the Save As dialog, click Training Files, and then, in the file window, double-click Imperial [Metric].
For File name, enter Getting_Started, and click Save

C. Imperial and Metric Convention

In this guide contain both imperial and metric values. This means that when you see an imperial value, a metric value is displayed in square brackets next to it. For example: In the Type Selector, select Basic Wall : Generic - 6" [200mm]
Double-click the level dimensions, and enter new values:
0'0" [0mm]: Change to -14'0" [-5250mm]
10'0" [4000mm]: Change to -10'0" [-3050mm]

D. Create levels in the building

Enter ZO to zoom out.
On the Design Bar, click Level.
On the Options Bar, click (Pick Lines), and, for Offset, enter 10' [3000mm]
According to Indian standards the sizes are 190*90*40 mm

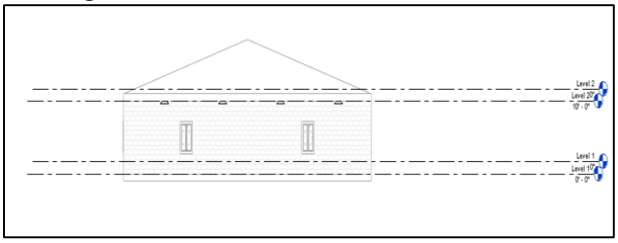

Fig. 1: Side View of super market

E. Creating Walls

We work on different levels to add foundation walls to the project.
In the Project Browser, under Floor Plans, double-click 00 Foundation to open that view in the drawing area.
On the Design Bar, click Wall.
In the Type Selector, select Basic Wall: Retaining - 12" Concrete [Basic Wall: Retaining - 300mm Concrete].
On the Options Bar:
Click (Draw).
For Height, select 02 Entry Level.
For Loc Line, verify that Wall Centerline is selected.
Verify that Chain is selected.

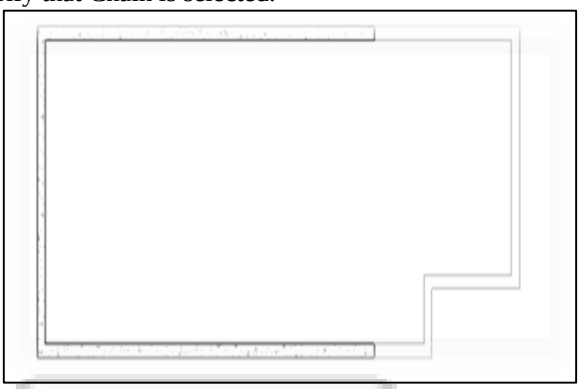

Fig. 2: Top View of super market

F. Adding a Roof

We create a roof using the footprint of the exterior walls. You specify an offset as you create the roof so that the roof has an overhang. Open the Roof floor plan.
Draw a roof line
On the Design Bar, click Roof ➤ Roof by Footprint, and then click Lines.
On the Options Bar, verify that Defines slope is selected.

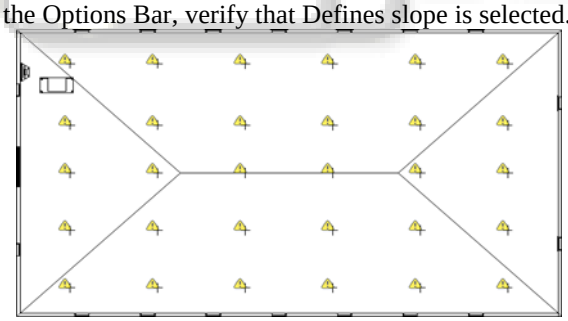

Fig. 5: Roof of super market

G. Adding Doors

You load doors from the Training Files folder into the project, and then add interior and exterior doors to the model.
On the Basics tab of the Design Bar, click Door. There are a limited number of door types in the project because there were few in the default template. You can load additional door types from the Training Files folder.
Load doors from the Training Files folder:
On the Options Bar, click Load.
In the left pane of the Load Family dialog, click Training Files, and open \Imperial\Families\Doors [Metric\Families\ Doors].
While pressing CTRL, select the door types: Bifold-4 Panel.rfa, Double-Glass 2.rfa, Single-Glass 2.rfa [M_Bifold-4 Panel.rfa, M_Double-Glass 2.rfa, M_Single-Glass 2.rfa].
Click Open. Add exterior doors:
Open the 01 Lower Level floor plan.
On the Design Bar, click Door.
On the Options Bar, clear Tag on Placement.
In the Type Selector, select Double-Glass 2: 72" x 84" [M_Double-Glass 2 : 1830 x 2134mm], add a door to the east wall as shown, and then click Modify
The Measurements of the Door are
762*1981 mm

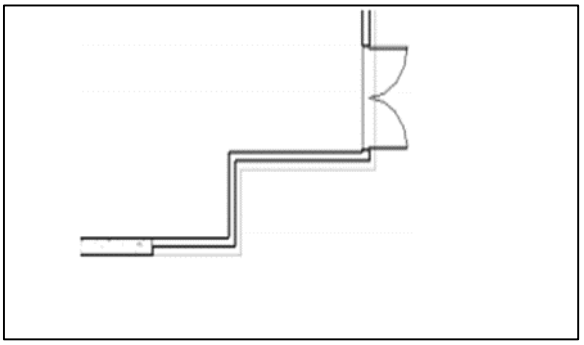

Fig. 6: Doors of super market

H. Adding Windows

You work in elevation and plan views to add windows to the model. You use alignment and dimension tools to more precisely position the windows. Add windows in an elevation view:
Open the South elevation view, and zoom in to the building.
On the Design Bar, click Window.
On the Options Bar, clear Tag on Placement.
On the Options Bar, click Load.
In the left pane of the Load Family dialog, click Training Files, and open \Imperial\Families\Windows [Metric\Families\Windows].
Select Casement 3x3 with Trim.rfa [M_Casement 3x3 with Trim.rfa], and click Open.
Add 2 windows, approximately as shown. You will position them and align them with the top of the retaining wall later. If either of the windows spans an internal wall, a warning.
The Measurements of the Windows are
Width: 28 inch
Height: 62 inch

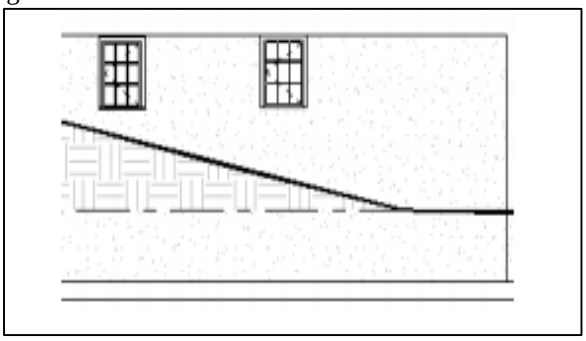

Fig. 7: Windows of super market

IV. RESULTS AND DISCUSSIONS

From the above calculations the estimated values the temperatures of different regions were find out and the project summary is provided and the temperature are provided.

In this all the parameters were taken into consideration for high accuracy and proper estimation of cooling load.

Based on the obtained temperatures for each location and season was done using Revit software. All the diagrams were shown in the civil plan. From this we can conclude that our estimated values are fair enough to establish the air conditioning system in the specified location. By using HVAC system energy consumption of the building is reduced as much as possible by avoiding unnecessary loses. This is one of the most well designed and most useful method in the present day installations.

The Temperatures obtained for Mumbai are

Temperatures	In celsius
Summer D.B.T	35
Summer W.B.T	26
Winter D.B.T	17
Mean Daily Range	11

Table 1: Temperatures of Mumbai

The Temperatures obtained for Bangalore are

Temperatures	In celcius
Summer D.B.T	35
Summer W.B.T	24
Winter D.B.T	15
Mean Daily Range	10

Table 2: Temperatures of Bangalore

The Temperatures obtained for Vizag are

Temperatures	In celcius
Summer D.B.T	35
Summer W.B.T	29
Winter D.B.T	20
Mean Daily Range	4

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