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Customer's Perception on Building Management Systems in Residential Complexes at Chennai

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Abstract: ***Customers should aware about the building management system (BMS) and their requirements based on the location of the apartment, type of the apartment and number of floors in the apartment. It is observed from various literature reviews that the customer requirements vary depending on the geographic physiological environment they are present in. Various techniques were followed and the project went up to 16 weeks. Observation of the customer requirements in BMS have been made and key areas to be focused based on location such as 1.Rural residents preferred having fire and alarm system and energy savings 2.Urban residents focused on Monetary, energy and security systems has been identified. Observation was also made based on the apartment type and customer requirements varied if the apartment is an individual standalone apartment or a multiple cluster of apartment. The other factor based on which the customers preference varied is the number of floors in the apartment, where as the floors increases the focus was on security systems, else the focus was on monetary savings. I also provide suggestions like elements to focus on rural apartment, urban apartment and standalone apartment.***

Keywords: Perception, Requirements, Savings and Standalone.

I. INTRODUCTION

A building management system (BMS), otherwise known as a building automation system (BAS), is a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment through HVAC Automation, Lighting Controls, Fire Detection& Alarm System, Access Controls, CCTV controls, Elevator & Escalators Controls. The system is consisting of software& hardware components integrated for complete automation of the buildings.

II. OBJECTIVES

- To identify the features of building management systems that is relevant for apartments.
- To determine the customers' perception on what is suitable for a smart building.
- To identify how various parameters like smart metering, building automation are perceived.
- To identify the factors that influence in buying a building management system.

III. RESEARCH METHODOLOGY

The research design used in this project is Descriptive Research.

SAMPLING DESIGN

SAMPLE SIZE

The sample size for this survey is about 204 people.

SAMPLING TECHNIQUE

The sampling technique used here is Simple Random sampling.

IV. HYPOTHEIS FORMULATION

I) LOCATION & DECIDING FACTORS

H0: There is no significant association between location of the apartment and important elements of BMS.
H0: There is no significant association between location of the apartment and important function of EMS.
H0: There is no significant association between location of the apartment and knowledge about fire accidents.
H0: There is no significant association between location of the apartment and important parameter of fire safety mechanism.
H0: There is no significant association between location of the apartment and strong points associated with BMS.
H0: There is no significant association between location of the apartment and deciding factor for buying BMS.

II) APARTMENT TYPE & DECIDING FACTORS

H0: There is no significant association between type of apartment and important elements of BMS.
H0: There is no significant association between type of apartment and important function of EMS.
H0: There is no significant association between type of apartment and knowledge about fire accidents.
H0: There is no significant association between type of apartment and important parameter of fire safety mechanism.
H0: There is no significant association between type of apartment and strong points associated with BMS.
H0: There is no significant association between type of apartment and deciding factor for buying BMS.

III) NUMBER OF FLOOR & DECIDING FACTORS

H0: There is no significant association between number of floors in the apartment and important elements of BMS.
H0: There is no significant association between number of floors in the apartment and important function of EMS.

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H0: There is no significant association between number of floors in the apartment and knowledge about fire accidents.
H0: There is no significant association between number of floors in the apartment and important parameter of fire safety mechanism.
H0: There is no significant association between number of floors in the apartment and strong points associated with BMS.
H0: There is no significant association between number of floors in the apartment and deciding factor for buying BMS.

V. CONSOLIDATED RESPONSE SHEET

TABLE 1.1 Location vs Important area of BMS

		Important areas of BMS					Total
		Energy Management systems	Fire & alarm system	Security system	Ventilation system	All of the above	
Location	Rural	0	19	3	3	3	28
	Urban-Fully residential	10	9	6	12	111	148
	Urban-Industrialized area	3	0	19	3	3	28
Total		13	28	28	18	117	204

TABLE 1.2 Location vs Important function of EMS

		Important areas of Energy Management					Total
		Automatic control of electrical appliances	Automatic control of room temperature	Continuous feedback on energy usage	Monitor consumption of individual appliances	Alert when consumption exceeds the budgeted bill	
Location	Rural	3	3	19	0	3	28
	Urban-Fully residential	12	12	6	9	109	148
	Urban-Industrialized area	6	3	0	19	0	28
Total		21	18	25	28	112	204

TABLE 1.3 Location vs Knowledge about fire accidents

		In case of fire accidents how occupants come to know about it					Total
		On the direction of others	Alarms related to fore safety	Direct fire cues such as smoke	Fire engine sirens	Fire safety management system	
Location	Rural	19	0	3	6	0	28
	Urban-Fully residential	3	109	21	9	6	148
	Urban-Industrialized area	3	0	3	3	19	28
Total		25	109	27	18	25	204

TABLE 1.4 Location vs Important parameter of fire safety mechanism

		Most important for fire safety mechanism					Total
		Fire alarms	Fire proof elevators working in extreme conditions	Automatic Fire extinguisher System	Emergency response system	Smoke and ventilation system	
Location	Rural	16	3	0	3	6	28
	Urban-Fully residential	6	3	117	19	3	148
	Urban-Industrialized area	0	22	3	3	0	28
Total		22	28	120	25	9	204

TABLE 1.5 Location vs Strong points associated with BMS

		Strong points associated with BMS				Total
		Desired comfort	Ease of use	Maintenance and effectiveness	Costs and savings both	
Location	Rural	19	3	3	3	28
	Urban-Fully residential	6	9	22	111	148
	Urban-Industrialized	0	22	0	6	28
Total		25	34	25	120	204

TABLE 1.6 Location vs Deciding factor for buying BMS

		Deciding factor for buying BMS					Total
		Energy savings	Fire and alarms systems	Monetary savings	Improved convenience	Security systems	
Location	Rural	22	6	0	0	0	28
	Urban-Fully residential	0	6	3	16	123	148
	Urban-Industrialized area	3	3	19	3	0	28
Total		25	15	22	19	123	204

TABLE 1.7 Preference based on location

	Important elements of BMS	Important functions of EMS	Knowledge about fire accidents	Important parameter of fire safety mechanism	Strong points associated with BMS	Deciding factor for buying BMS
Rural	Fire and alarm system	Continuous feedback on energy usage	On the decision of others	Fire alarms	Desired comfort	Energy savings
Urban Residential area	All parameter(Energy, fire safety, security & ventilation)	Alert when consumption exceeds the budgeted bill	Alarms related to fire safety	Automatic fire extinguisher system	Cost and savings associated	Security systems
Urban Industrialized area	Security system	Monitor consumption of individual appliances	Fire safety management system	Fire proof elevators working in extreme condition	Ease of use	Monetary savings

TABLE 2.1 Apartment type vs Important area of BMS

		Important area of BMS					Total
		Energy management systems	Fire & Alarm system	Security system	Ventilation system	All of the above	
Apartment type	**Individual Apartment**	3	19	22	6	6	56
	Multiple residential apartments / buildings	9	9	6	13	111	148
Total		12	28	28	19	117	204

TABLE 2.2 Apartment type vs Important function of EMS

		Important functions of energy management					Total
		Automatic control of electrical appliances	Automatic control of room temperature	Continuous feedback on energy usage	Monitor the consumption of individual appliances	Alert when consumption exceeds the budgeted bill	
Apartment type	**Individual Apartment**	9	6	19	19	3	56
	Multiple residential apartments / buildings	12	12	6	10	108	148
Total		21	18	25	29	111	204

TABLE 2.3 Apartment type vs Knowledge about fire accidents

		Knowledge about fire accidents					Total
		On the direction of others	Alarms related to fire safety	Direct fire cues such as smoke	Fire engine sirens	Fire safety management system	
Apartment type	Individual Apartment	22	0	6	10	18	56
	Multiple residential apartments / buildings	3	108	22	9	6	148
Total		25	108	28	19	24	204

TABLE 2.4 Apartment type vs Important parameter of fire safety mechanism

		Most important for fire safety mechanism					Total
		Fire alarms	Fire elevators working in extreme conditions	Automatic fire extinguisher system	Emergency response system	Smoke and ventilation system	
Apartment type	Individual Apartment	16	25	3	6	6	56
	Multiple residential apartments / buildings	6	3	117	19	3	148
Total		22	28	120	25	9	204

TABLE 2.5 Apartment type vs Strong points associated with BMS

		Strong points associated with BMS				Total
		Desired comfort	Ease of use	Maintenance and effectiveness	Costs and savings associated	
Apartment type	Individual apartment	19	25	3	9	56
	Multiple residential	6	9	22	111	148
Total		25	34	25	120	204

TABLE 2.6 Apartment type vs Deciding factor for buying BMS

		Deciding factor for buying BMS					Total
		Energy savings	Fire and alarm systems	Monetary savings	Improved convenience	Security systems	
Apartment type	Individual Apartment	25	9	19	3	0	56
	Multiple residential apartments / buildings	0	6	3	16	123	148
Total		25	25	22	19	123	204

TABLE 2.7 Preference based on apartment type

	Important elements of BMS	Important functions of EMS	Knowledge about fire accidents	Important parameter of fire safety mechanism	Strong points associated with BMS	Deciding factor for buying BMS
Individual apartment building	Security system	1.Continuous feedback on energy usage 2. Monitor the consumption of individual appliances	On the direction of others	Fire proof elevators working in extreme conditions	Ease of use	Energy savings
Multiple residential apartments buildings	All parameters (Energy, fire safety, security & ventilation)	Alert when consumption exceeds the budgeted bill	Alarms related to fire safety	Automatic fire extinguisher system	Costs and savings associated	Security system

TABLE 3.1 Number of floors vs Important area of BMS

		Important areas of BMS					Total
		Energy management system	Fire and alarms systems	Security system	Ventilation system	All of the above	
Number of floors	3 to 10	3	0	19	3	3	28
	11-20	0	19	3	3	3	28
	More than 20	9	9	6	13	111	148
Total		12	28	28	19	117	204

TABLE 3.2 Number of floors vs Important function of EMS

		Important functions of energy management					Total
		Automatic control of electrical appliances	Automatic control of room temperature	Continuous feedback on energy usage	Monitor the consumption level of individual appliances	Alert when consumption exceeds budgeted bill	
Number of floors	3 to 10	6	3	0	19	0	28
	11-20	3	3	19	0	3	28
	More than 20	12	12	6	10	108	148
Total		21	18	25	29	111	204

TABLE 3.3 Number of floors vs Knowledge about fire accidents

		Knowledge about fire accidents					Total
		On the direction of others	Alarms related to safety	Direct fire cues such as smoke	Fire engine sirens	Fire safety management system	
Number of floors	3 to 10	3	0	3	3	19	28
	11-20	19	0	3	6	0	28
	More than 20	3	108	22	9	6	148
Total		25	108	28	18	25	204

TABLE 3.4 Number of floors vs Important parameters of fire safety mechanism

		Important for fire safety mechanism					Total
		On the direction of others	Alarms related to safety	Direct fire cues such as smoke	Fire engine sirens	Fire safety management system	
Number of floors	3 to 10	0	22	3	3	0	28
	11-20	16	3	0	3	6	28
	More than 20	6	3	117	19	3	148
Total		22	28	120	25	9	204

TABLE 3.5 Number of floors vs Strong points associated with BMS

		Strong points associated with BMS				Total
		Desired comfort	Ease of use	Maintenance and effectiveness	Costs and savings both associated	
Number of floors	3-10	0	22	0	6	28
	11-20	19	3	3	3	28
	More than 20	6	9	22	111	148
Total		25	34	25	120	204

TABLE 3.6 Number of floors vs Deciding factor for buying BMS

		Deciding factor for buying BMS					Total
		Energy Savings	Fire & alarm systems	Monetary savings	Improved convenience	Security systems	
Number of floors	3 to 10	3	3	19	3	0	28
	11-20	22	6	0	0	0	28
	More than 20	0	6	3	16	123	148
Total		25	15	22	19	123	204

TABLE 3.7 Preference based on number of floors in the apartment

Number of floors	Important elements of BMS	Important functions of EMS	Knowledge about fire accidents	Important parameter of fire safety mechanism	Strong points associated with BMS	Deciding factor for buying BMS
3 to 10	Security system	Monitor consumption of individual appliances	Fire safety management system	Fire proof elevators working in extreme conditions	Ease of use	Monetary savings
11 – 20	Fire and alarm system	Continuous feedback on energy usage	On the direction of others	Fire alarms	Desired comfort	Energy savings
More than 20	All parameter(Energy, fire safety, security & ventilation)	Alert when consumption exceeds the budgeted bill	Alarms related to fire safety	Automatic fire extinguisher system	Cost and savings associated	Security systems

VI. FINDINGS

- The preference of more than 50% respondents is to have a BMS that focuses on all the area (Energy, fire & safety, security and ventilation system).
- More than 50% of the respondents feel that the energy management system helps in reducing the energy consumption and bill amounts.
- EMS helps in setting up a point above which if consumption is made it alerts the respondents. This is the important function preferred in EMS
- In case of fire accidents most of the people tend to get knowledge about the accident with the help of alarms related to fire safety.
- Respondents feel that more than any individual methods fire safety management is more beneficial.
- Of the various attributes in fire safety management system customers prefer to have Automatic fire extinguisher system followed by emergency response system, presence of fire alarms, elevators working in extreme conditions, smoke and ventilation system.
- More than 90% of the respondents choose to have ventilation system that controls the temperature according to the external environment.
- The strong point that is associated with the BMS system is the costs and savings associated with it.
- The deciding factor for buying a BMS system is the Energy savings & security systems associated with the system.

VII. SUGGESTINS

- BMS system for rural apartment must focus on the following parameters.
  - Fire and alarm system
  - Continuous feedback on energy usage
  - Energy savings
- BMS system for urban apartment must focus on the following parameters.

- Energy savings and security systems
- Monitor the consumption of individual appliances and alert when consumption exceeds the budgeted bill.
- Monetary savings
- Automatic fire extinguisher systems.

- BMS for individual standalone apartment must focus on the following
  - Security system.
  - Energy savings
  - Fire proof elevators working in extreme conditions
  - Continuous feedback on energy usage and alert when consumption exceeds the budgeted bill
- BMS for multiple cluster of apartment must focus on the following
  - Monetary and energy savings.
  - Monitor the consumption of individual appliances.
  - Alarms related to fire safety.
- Since the preference of customers vary based on location, apartment type and number of floors, it is necessary to identify specific requirements of customers for developing BMS.
- Awareness should be created about the use of BMS systems that help in reducing the energy consumption and bill amount, increase security and safety.

VIII. CONCLUSION

The project was undertaken to identify the level of customer awareness and their requirement in building management system. Analysis was done to identify the customer requirements based on the location of the apartment, type of apartment and number of floors in the apartment.

The project thus meets the major objectives such as

- ✓ Identifying the features of building management systems that are relevant for the customers and apartments.
- ✓ Determination of customers' perception on features suitable for smart buildings.
- ✓ Identifying the factors that influence the buying behavior of BMS.

The evaluations of features of BMS that are favored by customers have been established based on data collection, analysis and interpretation.

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