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APPLICATION OF DIGITAL SYSTEMS IN BUILDING SAFETY MANAGEMENT

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Abstract: *This study shows how new digital technologies will ensure the occupants' safety and security in a building. Building Information Modeling (BIM), Integrated Building Management Systems (IBMS), and Building Automation Systems (BAS) will all help to improve the building's security. We can implement a safe working environment with HVAC systems using advanced filters and also provide safe drinking water using treatment plants and softener plants with advanced mechanisms like RO purification, etc. As the safety of buildings plays a major role in rescuing buildings in case of fire with advanced fire protection systems like sprinklers, extinguishers, firewalls, fire alarms, etc., there are many passive and active protection systems. The built environment can be protected with many security technologies like boom barriers, solar fencing, CCTV systems, access control, intrusion alarms, etc. Buildings can also be protected from natural calamities like lightning and earthquakes by using shear walls and lightning arresters, etc. All the above systems are maintained by proper facility management, and it is their role to ensure the occupants' safety, comfort, and also take care of building functionality that helps in improving the lifetime of a building. The role of the facility management head is to look after all the aspects of the building and ensure the operation and maintenance of the systems.*

Key words*: Facility Management, Indoor Environment Quality, Access Control, Fire Protection Systems, Building Automation.*

1. INTRODUCTION

Building managers always had a lot on their plates. With the outbreak of the epidemic, these fears multiplied. These are two of the main services provided by our built environment. However, these are separate facets of building management, and each is critical to maintaining a structure's integrity. Whether the facility in question is a school, an office complex, a healthcare institution, or a manufacturing plant, users need to know that they can conduct business in a safe and secure setting once all inefficiencies have been addressed.

Building safety, as applied towards the built environment, refers to the processes and activities in place to guarantee that a building's users are safeguarded against dangers caused by unintended injury.

Errors are the leading cause of safety concerns. Human mistake, non-compliance, weariness, stress, and mechanical failure are all major reasons. With so many concerns involving employees, the first step in developing safety programmes should be to redesign the people's general safety knowledge, culture, and practices. Accidents and incidents can be kept to a minimum by increasing their awareness and handling of day-to-day safety issues.

While humans are the most essential feature of a structure's safety, the technical aspects of any building must

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also be considered. Firefighting systems and electrical equipment are two examples of equipment that have a direct influence on safety.

Building security, but in the other hand, refers to the methods and activities put in place to secure a building and its residents or property from purposeful attacks. Your building's outdated access control technology has faults that can expose it to a variety ofthreats, including violent attacks, property theft, and data breaches. If you discover that your installation is obsolete and insecure, you should study and implement security improvements right away. There are various cost-effective and less disruptive choices available on the market. Security simulations are also useful for identifying flaws in your security processes and determining how prepared your building is for a possible security breach. Rather of attempting to manage and track your security manually, technology can help you[1]

Aim of the study:

To study about various safety and security aspects that can protect built environment by achieving with proper implementation and managing of systems.

Need for Research:

The purpose of the study is that day by day there is enormous growth of high-rise buildings and skyscrapers. In that case, safety and security are becoming major concerns, and in those areas we need to achieve a safer and more secure building environment. This study addresses the various requirements regarding safety and security in a building and methods to achieve such an environment.

2. LITERATUE REVIEW

In buildings where people may consume water, use water for preparing food, washing, bathing, swimming, or other recreational activities, or be exposed to aerosols created by water-using machines such as cooling towers, guidance is offered. Hospital, colleges, kid and aged-care services, health and dental centres, hotels, apartment complexes, sport centers, commercial structures, and transportation terminals all have these purposes. Inadequate water management in buildings has significant health consequences, as well as significant indirect economic and social and environmental considerations. [2].

Security and safety solutions have gotten a lot of attention lately since they are important parts of modern buildings that are becoming more common in critical infrastructures. This thesis presents a privacy and protection system for buildings. The entry control system, CCTV system, and firefighting system are the subjects of this study. Each system's installation and the opportunities it provides. This method provides the greatest answer to the majority of issues that building residents confront, such as thefts, asset invasion, fire dangers, and other concerns [3].

Buildings make up the majority of constructed infrastructure and are critical to a country's socioeconomic growth. Nowadays, fire safety in structures is ensured by adhering to the recommendations of building codes of practice. While the requirements and tactics for providing fire prevention in buildings differ from one code of practice to the next, the majorities of them are prescriptive in nature and are based on similar fire safety concepts. Building fire safety is supplied through a mix of passive and active fire prevention devices in prescriptive based methods. To increase fire safety in structures, a new integrated framework on fire prevention features in buildings, regulation and enforcement, consumer awareness, and technological and resource progress is required[4].

Intelligent Buildings are networks of linked devices and software that manage and regulate various building operations such as HVAC, smoke detectors, lighting, shading, and more automatically. These systems have progressed from primarily electrical and mechanical components to complicated systems that rely on information technology (IT) and wireless devices and networks. As a result, smart buildings are exposed to new risks and threats that must be identified and managed. Building automation systems are designed to assist all house operations, such as lighting, air conditioning systems, heating, shading, and access, in order to improve comfort, conserve energy, and simplify administration [5].

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Sector has contributed to climate change impacts globally by using about 40%, 25%, and 40% of fuel, water, while resources, respectively, and accounting for 1/3rd of total emissions. Green building approaches for environmental sustainability in construction are discussed in this chapter, with obvious medical, environmental,

social, and financial advantages. The green building practices recognize the metrics and reaches for (a) site and framework design optimization, (b) efficient energy, water, and resources, (c) decrease of environmental damage, (d) augmented IAQ, air circulation, comfort conditions, day lighting, and anechoic surroundings, and (e) improvement of maintenance and operation [6].

Literature Gap:

In modern buildings, making the occupants feel safe and assured is not linked to a single service or aspect, all the building services should deliver safe outcome. All the above studies in literature review are addressing one single facility or service of the building and integrated approach in missing. In this paper, we addressed all the aspects of building services with regarding to safety and security[7].

3 METHODOLOGY

In the literature study we studied about the different systems that are there in the market and in further we are going to analyze the advanced systems in different aspects like HVAC, firefighting, security systems that can be helpful in maintaining the safe and secure built environment.

STUDY AND ANALYSIS

We can see there are many advanced technologies that can assure safety and security of built environment. And they are diversified into various different services of the building. Few address the health safety of the occupants, few addresses the health and durability of the building and few others are about comfort and wellbeing of the occupants. Here we can see some of those one by one,

Meeting Water Standards

It is seen that many places we are not having proper water which is not safe to consume sowe need to maintain and look after the ph levels. In a built environment we need to properly maintain the water quality, there are many advanced technologies water softeners and STP's which will reduce the impact on human and environment. These will soften the water by maintaining water mineral balance and by removing toxic substances. In these we are having reverse osmosis and ion exchange softeners which are very well advanced in maintaining the water standards. In case of sewage water we need to treat them to reduce adverse effects on environment so there are advancements like MBBR, SBR etc[8].

Fire Protection Systems

In case of building fire protection aspects is the major concern to safe guard the occupants. Inthis we are having many passive systems like fire walls, fire rated doors, etc and there are some active fire protection systems sprinkler, detection systems, control systems, fire alarms etc and in case of some crucial spaces we need to place advanced extinguishing systems like novec1230, fm200, etc so these are have to be operated and maintained well in every spaceby meeting the fire norms[9].

Access Control

Access control systems are the electronic systems that are designed to control through a network and they should have an access to a network. Access Control System recognizes authenticates and authorizes entry of a person to enter into the premise thereby giving complete protection ensuring security with the system. Access control system is one of the most common used systems in electronic door control using a card or a magnetic stripe whichcan be

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accessed by swiping through a reader on the door. In this we are having proximity access systems biometric systems etc.

Boom Barriers

Boom Barriers are horizontal poles or bars pivoted to manage the flow of the vehicle by allowing or halting the vehicle. The boom barriers replaced traditional manually operated ones to the automatic boom barriers.

Taking in to the considering scenario. where we can see the digitalization of the Road traffic control and management system and digitalized approach towards everything there needs automatic boom barriers. There are different ways of controlling by remote control, push button etc.

CCTV Systems

Closed-circuit television, or video surveillance, is the abbreviation for closed-circuit television. In contrast to "normal" television, which is broadcast to the general public, "closed-circuit" television is broadcast to a small (closed) number of monitors. CCTV networks are widely employed to identify and discourage criminal activity and to record traffic violations, but they may also be used for other purposes. Typically, they are employed for security purposes in any type of structure. We can keep an eye on our surroundings and keep them safe.

Laser Security Systems

Security System using Lasers this is a sort of laser-based security system that includes laser light and light-based sensors. This method guards against unwanted access at the office, at home, in lockers, and elsewhere. There are many different types of security systems availableon the market, but the laser security system is one of the most effective and vital. When a system detects any unusual behavior, it emits an alert or another sound. This system may be enhanced by including an automated system and ensuring that users have a high level of security while sending messages or making phone calls to the owner. In this project, we created a basic laser-based security system that can be built at home. This system acts like a tripwire like a security system and makes a sound of the alarm when the laser is interrupted[10].

Solar Fencing

Solar fencing is a modernized and unconventional method which is one of the best options of providing security as it is both effective as well as efficient. Not only does solar fencing guarantee the safety of one's property, but it also uses renewable solar energy for its functioning. A solar fence works like an electric fence which delivers a brief yet fierce shock when human beings or animals come in contact with the fence. The shock enables a deterrent effect while ensuring that no loss of life is caused[11]

Lightning Arresters

A lightning is a device used on electric power transmission and telecommunication systems to protect the insulation and conductors of the system from the damaging effects of lightning. The typical lightning arrester has a high-voltage terminal and a ground terminal.

When a lightning surge travels along the power line to the arrester, the current from the surge is diverted through the arrester, in most cases to earth. A lightning arrester is placed where wires enter a structure, preventing damage to electronic instruments within and ensuring the safety of individuals near them. In these we have horn gap, multi gap, valve type etc.. we need to choose based on type of building and usage.

Building Information Modeling:

BIM is a type of collaboration software that allows each field to add digital, treatment center knowledge to a single shared modeling process, which is usually done online. The capacity to create 3D graphics is the most noticeable feature. This style of depiction makes it easier to visualize how a complicated site or a finished structure will appear, how people would move around, and how areas are connected to one another, which is crucial criteria for security and safety management.
Construction safety, service safety, crisis strategic planning, occupational health and safety management, safety

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analysis, fire engineering, and a variety of other elements benefit greatly from BIM[12]

Indoor Environmental Quality:

Indoor environmental quality (IEQ) is a term that describes the state of a building's environment in terms of the health and well-being of individuals who use it. Many elements influence IEQ, including illumination, air quality, and humid conditions. Building occupants are exposed to a wide range of pollutants (in the shape of particles and gases) from office equipment, cleansers, construction works, rugs as well as furniture, fragrance, tobacco smoke,

moisture construction materials, growth of microorganisms (fungal, mould, and bacterial), insect pests, and outdoor pollutants. Indoor air, humidity levels, and ventilation levels, among other things, can influence how people react to their surroundings[13]. It can be maintained by

- Make use of natural light.
- Install windows that can be opened.
- Provide comfort and air control to the inhabitants.
- Allow tenants to manage the illumination.
- Organize occupant surveys.
- Provide furniture that is both comfortable and functional.
- Include an acoustic design that is acceptable.

Emergency Action Plan:

The design of a custom-tailored building emergency response plan is a flexible procedure that considers all features of your structure. The document must be simply comprehended, useful, and practical in order to become an unit - linked for the building's residents. The Facility Emergency Action Strategy Model is a flexible framework that allows each building to construct a plan that is adapted to their unique surroundings [14]
When a facility has a threat, including a fire or a chemical leak, inhabitants must be evacuated or transferred to a safe spot. Other events that may necessitate evacuation include a bomb scare or the receipt of a hazardous shipment. Everyone should be evacuated to the strongest area of the structure and away from external glass if a storm warning is issued. The fire service may issue a "shelter-in-place" warning if a mobility accident on a neighboring roadway results in the discharge of a chemical cloud. "Lockdown" must be announced to safeguard employees from a violent act, and should hide or block themselves from the culprit[15].

Remarks:

For every service there will be some areas where we it can be adapted so as the safety and safety is mostly related to digital technologies in these days so every services contributes in their own way. Maintaining the air quality differs from area to area, in some areas like critical places we need to maintain high safety equipment’s. We have to meet the water standards in every type of building for the wellbeing of the occupants and the fire safety is also most essential case, now a day’s every building needs safety standards based on the usage of buildings [16].
As the security aspect is most important so every building needs some amount of security and some buildings where there is much need of security we need to equip with recent technologies. We are having most advanced systems like access control, boom barriers, solar fencing, CCTV systems etc which are very useful in critical and non-critical buildings also. Most advancement like BIM, automation helps to coordinate all the aspects and helps to offer safety, security, and comfort to occupants in their day to day life[17].

4.CONCLUSION

Whenever it comes to security and safety, a structure might be injured in a variety of ways. An unprovoked attack or theft might put your company's finances in jeopardy, from stolen identities to jeopardized personal information. Protecting your building safeguards your physical assets, information technology assets, and personal safety. Building security that is well-thought-out may provide your staff and customers with peace of mind. This is true regardless of the type of activity that the building engages in.
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quality, and humid conditions.
Protecting human health, improving quality of life, and reducing stress and possible injuries are all strategies for addressing IEQ. A better indoor environment can improve inhabitants' lifestyles, boost the property's market value, and lessen risk for building owners.
Healthy buildings offer a variety of advantages to their residents. Healthy buildings also improve air quality, give access to safe drinking water, and provide more pleasant lighting and acoustics, in addition to reducing negative health effects. These enhancements boost productivity while also providing long-term benefits to the building's inhabitants. A secure atmosphere attracts and maintains employees and renters, so owners and managers gain as well.

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