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SOLAR ENERGY IN SMART HOMES

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ABSTRACT

If you've ever been in a smart home, you'll know what I'm talking about. In order for a house to remain connected and smart, it must have a steady and stable supply of electricity. Smart houses will not be possible in countries, where a consistent supply of electricity is still an issue. Solar photovoltaic technologies will solve this problem and make smart homes possible in such countries. Using solar photovoltaic technology to power smart houses is the subject of this article.

Keywords: Smart Home, Solar Photovoltaic, Integration, Power.

I. INTRODUCTION

Home automation systems are used in smart homes to provide improved monitoring and control over the building's activities through internet-connected gadgets (figure 1). In a smart home, temperature, security, window and door operations, garage, lighting and multi-media are just a few of the elements that may be controlled. Many parts of a house are closely monitored by internet-connected gadgets in smart homes, providing home owners with valuable feedback and information.

Computer systems in a smart home may monitor a variety of elements of everyday living that gives the appearance that the home is intelligent. For example, the refrigerator could be able to stock itself, advise meals, offer healthier options, and request food stuffs. Smart home systems may even irrigate the plants. Like the transition from "dumb" mobile phones to smart phones that link to the internet, a smart home is all about connection. Smart homes have the potential to make life easier and more convenient for their residents. Smart houses are believed to be more secure than traditional residences. Modern home automation systems require more wiring and controllers. If you have a home automation system, you have the ability to monitor your house at all times. The entryways may be monitored remotely using cameras, motion detectors, and locks.

Adding smart features to an existing home is more expensive than developing one from scratch because of the difficulty of routing wiring and placing sensors in appropriate locations. There was a discussion of the types and combinations of several commercially available smart home devices that focus on energy in, which explored how they may operate together to serve user and grid requirements.

Smart Home Energy Management Systems (SHEMS) are not widely used in many countries since there is no clear direction for their implementation. Significant differences occur between the various nations. For independent or exigency frameworks, SHEMS is typically used as an integrated framework with localized generation methods (LGMs). Toshiba

played a key role in the establishment of private companies in Japan that were tasked with regulating energy use in homes, buildings, and industrial sites. Panasonic and Singapore's legislature collaborated on a SHEMS pilot project.

Figure 1: A graphical representation of a smart home

II. SMART HOME AND INTERNET OF THINGS

When it comes to wireless sensor networks, the internet of things (IoT) is not a new idea; it is essentially a wireless sensor network that is connected to the Internet. Smart houses may be thought of as residences with internet-connected gadgets. To programmed these gadgets, companies create software. The goal is to make people's lives simpler through the use of these devices. If you think about it, there are a lot of places outside of the home where you could require linked devices. If a car had a gadget that tracked where it went and how much it wore down, that would be great. All of this information would be sent to the cloud, where it would inform the driver when it was time to realign the wheels or change the tyres. Even the gadgets and the Internet of Things fall into the smart home category.

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III. SMART HOME ADVANTAGES

Smart homes have the potential to make life easier and more pleasurable. Peace of mind may also be achieved through home automation and home networking. Smart houses provide a number of advantages, including but not limited to:

A. Intelligence in the home and security

Breaking and entering is a common method of committing burglaries and robberies in homes. Locks on doors are often picked, and alarms are deactivated as a result of the thefts. Being able to live in a smart home reduces the likelihood of such occurrences occurring in the house. A smart home will turn on security lights, close all entryways electrically in the event of an interruption, sound all alarms, and notify the owner of any possible hazards to the property.

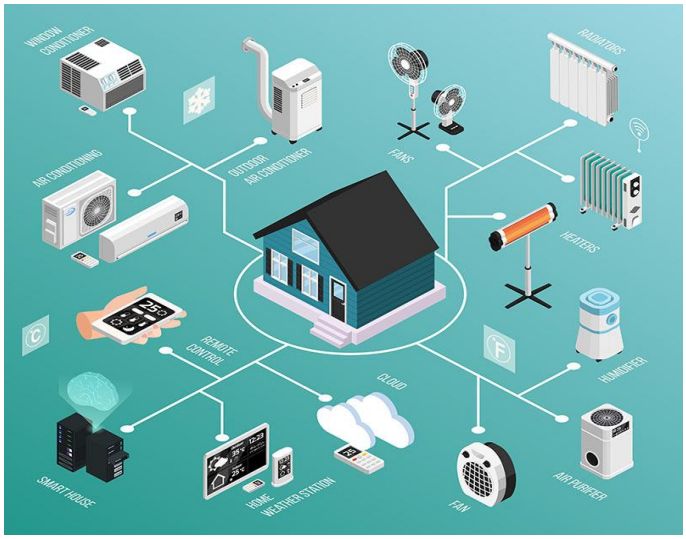


Figure 2. Home Automation with IoT

Medical concerns, break-ins, fires, gas spills, surges, and more can occur in a smart house. Different unexpected events are specified in the Home Intelligence (HI) module as well as information about the event's likelihood or a prediction thereof as well as extra data regarding suitable replies. In fact, the HI module checks the smart home's database, detects anomalous conditions, responds by suggesting suitable alerts, and triggers the right reaction required to manage that particular occurrence. The framework is arranged to characterize applicable potential outcomes identifying with the occasion as per the information got and to react as needs be.

Rather than being a collection of advanced appliances and gadgets, the home intelligence makes an incorporated domain in which the artificial intelligence system can deduce and appropriately respond as indicated by changing factors and situations. By recognizing irregular or unexpected occasions and, when important, alarming the home's residents, the home intelligence module can give an instantaneous programmed reaction .

B. Consumption of Energy

Efficiency and savings have been a key challenge in recent years due to the growth in energy use, energy bills, and environmental concerns. It is vital to do research on the utilisation of home electricity. The smart home system makes the control of household electrical equipment more systematic and home energy management simpler. To maximise energy efficiency, smart houses and smart technology are becoming increasingly popular. To control energy usage and enhance building efficiency, real-time internet monitoring is essential. Buildings consume two-thirds of worldwide electricity. As long as it's done correctly, home automation will improve energy efficiency and reduce utility costs. It is possible to have your lights and appliances turn on and off at predetermined intervals by utilising a smart home automation system, which can be controlled from any place with an internet connection. This can help you save money on your energy costs, and it can also improve your security. As a result of smart houses, homeowners may pick whether parts of the house will be powered by solar panels, home batteries, or grid electricity.

There is evidence that energy management houses and efficient household energy management minimise energy bills. Researchers compared the performance and quality of 308 home energy management products in a study that spanned over a two-year period. Other potential advantages of interest identified with accommodation, solace or safety led to the possibility of offsetting savings on numerous occasions. Opportunities for energy conservation (behavioural and operational) as well as load shifting across many product categories were also identified.

C. Disability and age-related dependency reduction, as well as health problem management.

Needs differ across individuals, therefore help with smart homes must be customised for each person. Elderly, chronically ill and disabled folks can benefit from smart homes. In smart homes, the quality and variety of information conveyed to the physician is enhanced. Physical indicators and behavioural patterns can be translated into precise health risk forecasts that can be recognised at an early stage and used in conjunction with alarm-triggering devices to prompt appropriate action.

For example, smart houses may alert occupants when it's time to take their medication, alert medical personnel in case the resident collapses, and keep track of their food intake. Smart homes can take care of errands for an older person who is forgetful, such as shutting off the water before a bath floods or turning off an oven when someone has wandered away from home. A similar benefit is that adult children in different regions can assist with the care of their elderly parents. Those who are disabled or have a limited range of motion might also benefit from home automation systems. As a whole, smart homes minimize reliance on others, especially for the elderly or disabled, and they assist in managing health concerns.

D. Convenience and Comfort

It's all about convenience. With smart houses, comfort is improved, and labour is considerably reduced, thanks to the use of technology. It will be possible to customise all of your gadgets. It's up to you how many or how few of these items you want to use. Better security is one of the most well-known benefits of smart homes. Smart people may add immensely to the enjoyment of a home's everyday life.

E. Attract Buyers and Increase Property Value

One thing that many people desire is a smart house. It is estimated that a fully automated house with all of its appliances installed and working properly will enhance the value of a property by a factor of ten. The increased sales price will recoup all the improvements and other investments that went into making a house smart. Only if you're looking to sell your house and move elsewhere may you use this method.

F. Control the Temperature and Ventilation Systems

Individuals using smart home technologies may regulate the temperature in their homes as well as fans and ventilation systems. Open the blinds and windows, switch on and off fans, and so on to ensure that the environment in your home is perfect.

IV. SMART HOMES AND PHOTOVOLTAIC INTEGRATION

The globe is undergoing a series of revolutions, from energy sustainability to the development of smart household gadgets that may improve quality of life, reduce costs, and help the planet. An energy efficient house where equipment can be monitored and electricity is collected from sustainable sources and saved for later use is an appealing notion, which is why the concept of a solar-powered smart home is so appealing. Many countries are working towards a future in which energy consumption can be completely controlled. Solar electricity will play a major role in this. If you live in Northern California or Africa, installing a solar PV system is a great idea. Because of their numerous advantages and ability to reduce energy usage in general, smart houses are not extensively used in Africa yet. Across Africa, energy availability and accessibility remain key issues, making powering these smart houses a big concern. A smart home's goal will be undermined if there is no or a limited supply of power to properly monitor and manage it. A major advantage will come from combining solar photovoltaic (PV) technology into intelligent homes or intelligent buildings. As a building energy source, solar power is one of the most widely employed renewable energy sources. These include solar water heating and cooling as well as photovoltaic (PV) power generation. When it comes to installing these new technologies, affordability and ease-of-use are

significant concerns. The home sector has two options for utilising solar energy: solar thermal and solar photovoltaic (PV). The idea of a smart house powered by solar energy is enticing.

Through the integration of housetop PV with energy-efficient interior regulators, web-enabled devices, and energy tracking software, people will soon have relatively complete control over their energy consumption. This may be done remotely via a mobile phone application that is connected to the electrical board using a device called Sense, which connects the board to a little box.

Households with smart houses constantly monitor PV output and usage with the eventual objective of optimising solar power usage. In order to achieve optimal load adequacy, the control framework combines planning, control, and capacity frames. PV framework admins may see a detailed breakdown of their installation. As a result, there is more transparency, greater independence, less power usage, and lower energy costs. On-the-roof Photovoltaic systems are one of the most important uses of solar PV technology. It became increasingly important to have a monitoring and control system in place as rooftop PV power generation grew in popularity. A PV system on the roof of a residential building, for example, is shared by all the houses in the building. A smart device is defined as any distributed renewable energy source. PV systems have grown more affordable for individual houses because of their simplicity and appropriateness for installation.

An example of a typical PV-integrated home load profile (5 kWp). Detecting when electrical loads that significantly impact consumption should be activated and deactivated using this diagram is possible. Solar PV may be utilised during 16:00 hours to minimise grid power prices by shifting loads to 20:00 hours when grid energy costs are high. Increased independence from power providers is achieved by adding scalable batteries that can store huge amounts of solar energy. The SMA Flexible Storage System features a battery inverter with a large overload capacity and can provide virtually all the power needed when the grid goes down, as an example.

It is possible to store surplus electricity during the day and use it later, such as at night when PV generation is low. This can be done by storing significant amounts of solar power in thermal energy storage devices that are already accessible in most houses and have the ability to do so. It is clear that the benefits of a solar-powered smart home outweigh the drawbacks of having one. Incorporating solar PV into smart homes has a number of other advantages.

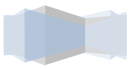
V. LIMITATIONS

Technologies for the smart home are fraught with dangers. Initial installation costs for some smart goods, especially when solar PVs are included, can be high. A certain amount of education may be necessary for those who are not tech savvy. Smart homes' functioning is heavily reliant on internet connectivity, thus they are useless without one. The benefits of owning a smart home outweigh the disadvantages, but there is one notable drawback that cannot be ignored. Earlier this year, more than a hundred countries suffered a setback when their PCs were kidnapped for ransom.

The same thing may happen with smart houses. No matter what security measures and software are in place to prevent a hacker from entering a property, thieves will still attempt to get into a home. No one can be 100% safe. That's a major obstacle that everyone is afraid of. An important security option for those who are just getting into the internet is education, which in many situations may be as simple as using new passwords instead of the factory default ones. Numerous smart home groups and protocol boosters are eagerly working on ways to reduce the chances of being compromised.

VI. CONCLUSION

As a result, smart homes offer a wide range of exciting possibilities for improving the way people live and work, as well as reducing total energy usage and costs. Everything of your home is under your control, and you can even monitor how much money you save with an integrated solar PV system from anywhere in the globe using your mobile phone. You need solar



PV in order for your home to be linked and smart. Solar integrated system makes a home even more intelligent. Residential energy storage and generation is expected to rise high in coming future in the form of solar smart houses.

REFERENCES

[1]. D. Bregman, "Smart home intelligence - The eHome that learns," Int. J. Smart Home, vol. 4, no. 4, pp. 35–46, 2010.

[2]. J. R. Rosslin and K. Tai-hoon, "Applications, Systems and Methods in Smart Home Technology : A Review," Int. J. Adv. Sci. Technol., vol. 15, pp. 37–48, 2010.

[3]. V. C. Gungor, "Smart Grid Technologies: Communication Technologies and Standards," in IEEE TRANSACTIONS ON INDUSTRIAL INFORMATICS, 2011.

[4]. Zhu, Ting, Aditya Mishra, David Irwin, Navin Sharma, Prashant Shenoy, and Don Towsley. "The case for efficient renewable energy management in smart homes." In *Proceedings of the Third ACM Workshop on Embedded Sensing Systems for Energy-Efficiency in Buildings*, pp. 67-72. 2011.

[5]. Lugo-Cordero, Hector M., Abigail Fuentes-Rivera, Ratan K. Guha, and Eduardo I. Ortiz-Rivera. "Particle swarm optimization for load balancing in green smart homes." In *2011 IEEE Congress of Evolutionary Computation (CEC)*, pp. 715-720. IEEE, 2011.

[6]. Abras, Shadi, Sylvie Pesty, Stéphane Ploix, and Mireille Jacomino. "Advantages of MAS for the resolution of a power management problem in smart homes." In *Advances in Practical Applications of Agents and Multiagent Systems*, pp. 269-278. Springer, Berlin, Heidelberg, 2010.

[7]. Cheong, Yun-Gyung, Yeo-Jin Kim, Seung Yeol Yoo, Hosub Lee, Sunjae Lee, Seung Chul Chae, and Hyun-Jin Choi. "An ontology-based reasoning approach towards energy-aware smart homes." In *2011 IEEE Consumer Communications and Networking Conference (CCNC)*, pp. 850-854. IEEE, 2011.