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Swarm Intelligence for Smart Homes Activity Prediction and Algorithm Trading

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Abstract

An ordinary house with a variety of sensors or smart gadgets placed to record the daily activities of its occupants is called a "smart home" (SH). Three elements are combined to create a smart home: (a) physical electronic devices like sensors and actuators; (b) a monitoring and control system that uses artificial intelligence or an expert system; and (c) a communication system that can be wired or wireless. The communication system in a smart home setup serves two purposes: it facilitates the implementation of the internal home network and facilitates the operation of the external home network. Connecting the sensors and gadgets placed throughout the house creates an internal home network. In a smart house, artificial intelligence is typically utilized to support the internal home network. The smart home system is connected to the outside world via the external home network. The Internet and mobile networks serve as external home area networks.

Keywords: Smart Home, Internet of Things, Artificial Intelligence.

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Introduction

The smart living environment has undergone significant change due to advancements in sensing, communication, and ambient intelligence technologies. Among these, smart homes stand out for improving people's quality of life. The original idea behind the smart home concept was to integrate several services in a typical household setting utilizing a standard communication infrastructure (Sepasgozar et al., 2020). These days, technological advancements have created smart homes that assist the elderly, the disabled, and those in need. When developing an assisted living system, health conditions that affect the elderly and require ongoing monitoring, such as diabetes, heart conditions, etc., must be taken into account. Age-related health problems such diabetes, cardiovascular disease, Parkinson's disease, Alzheimer's disease, and impairment of bodily functions are common among the elderly population (Cottone et al., 2015). By empowering seniors to live independently without sacrificing safety and security, smart home technologies may help to enhance quality of life. It helps caregivers save time and money on medical treatment while providing health professionals with the information they need to monitor seniors continuously. A system for smart homes is used for managing all the home gadgets like Surveillance devices, Monitoring devices, kitchen appliances, Media and entertainment devices, Health monitors and even Pet Maintenance system. Everyday mundane tasks can be automated and routine can be automated with Smart Home devices. A Smart Home system comes with easy to install PnP smart device and companion APP that should be installed in the User's mobile phone to register and with which the User can track the functionalities of the smart devices (Saad al-sumaiti et al., 2014). General Smart Home Automation System shown in Fig. 1.



Fig. 1: General Smart Home Automation System

System Model and Assumptions

These articles address a variety of subjects, including dynamical systems, bioinformatics, medical informatics, scheduling, combinatorial optimization problems (Thakkar & Chaudhari, 2021). Phases of Creating Smart Home Assisted Living System shown in Fig. 2.

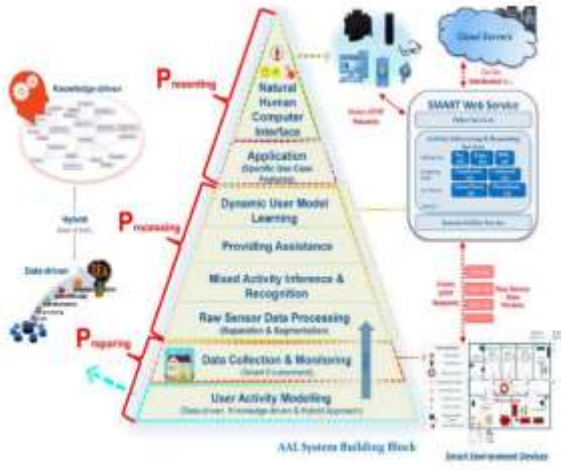


Fig. 2: Phases of Creating Smart Home Assisted Living System

There are still a lot of intriguing uses for SI that have not yet been fully realised, particularly in the field of bioinformatics. Over the past few years, there has been a steady but slow growth in the number of research publications that have successfully applied SI methods in bioinformatics. This is because many bioinformatics activities necessitate optimizing a number of variables (e.g., overlap strength, alignment score, energy, etc.) (Du et al., 2019). Smart Homes Activity shown in Fig. 3.

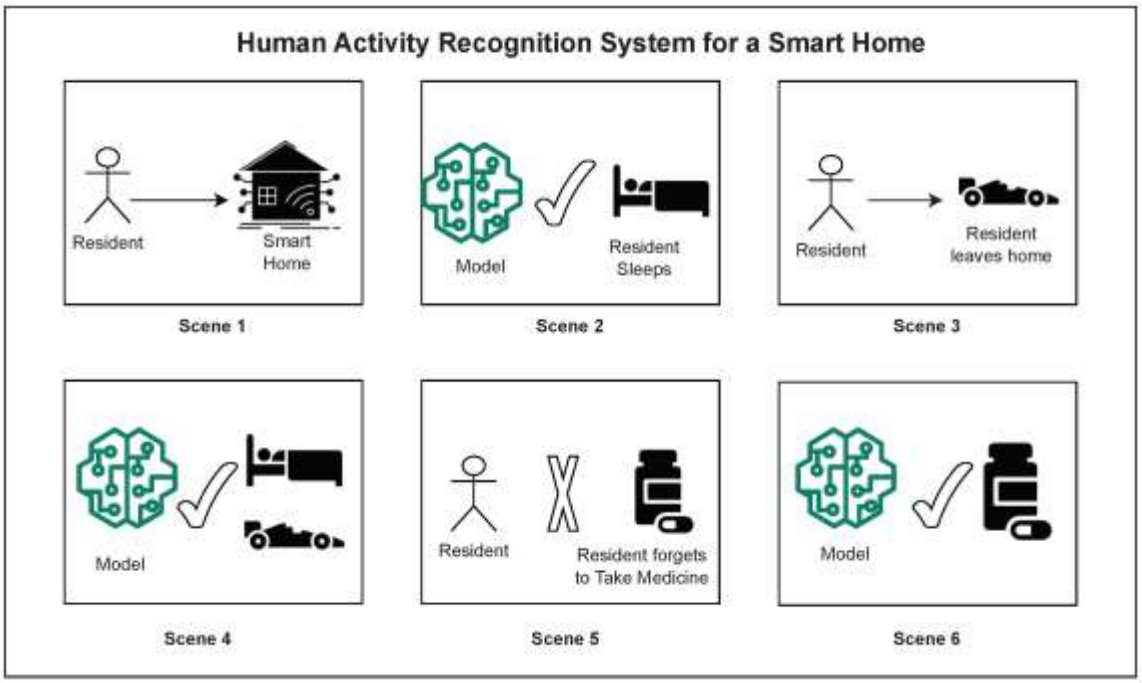


Fig. 3: Smart Homes Activity

Numerous SI algorithm implementations showed that they are efficient, dependable, and computationally inexpensive optimization strategies, which increased the visibility and appropriateness of their applications in bioinformatics (Alam et al., 2017).

Applications of Swarm Intelligence in Smart Homes

Swarm intelligence has been applied to the automation of intelligent homes in recent years, where it can greatly increase user convenience, safety, energy efficiency. Smart houses contain various devices, such as lights, thermostats, security cameras and appliances, which often operate independently. High intelligence algorithms can coordinate these devices to work together more effectively. For example, by observing the models in a user's daily routine, intelligent devices can automatically communicate and adjust the settings to optimize the use of energy. When the user leaves for work, the lights can turn off, thermostats can adapt to save heating or cooling energy and the safety systems can take action, all without requesting the user to manually program each device.

Another area where swarm intelligence improves intelligent domestic systems is safe. By using distributed sensors and cameras, intelligent domestic systems can create a network that monitors for unusual activities or threats. Each device can share information and insights with nearby devices, allowing responses in real time to violations of safety or notices. For example, if a movement sensor detects an unexpected movement, it can communicate this information to cameras and alarm systems, creating a coordinated response (Alam et al., 2011).

In summary, Swarm Intelligence provides a powerful picture to improve the automation of the intelligent house using decentralized decision -making strategies. This approach leads to the coordination optimized between devices, to improve energy efficiency, safety and the general experience of the user in daily life, Intelligent home automation systems are part of an increasing technological landscape that brings together various devices and technologies to improve daily life. These systems connect devices via the Internet of Things (IoT), enabling communication and collaboration amongst them. These days, smart locks, security cameras, smart lighting, and smart thermostats are all found in smart homes. Every one of these gadgets contributes to making homes more practical, safe, and efficient (Wu et al., 2017).

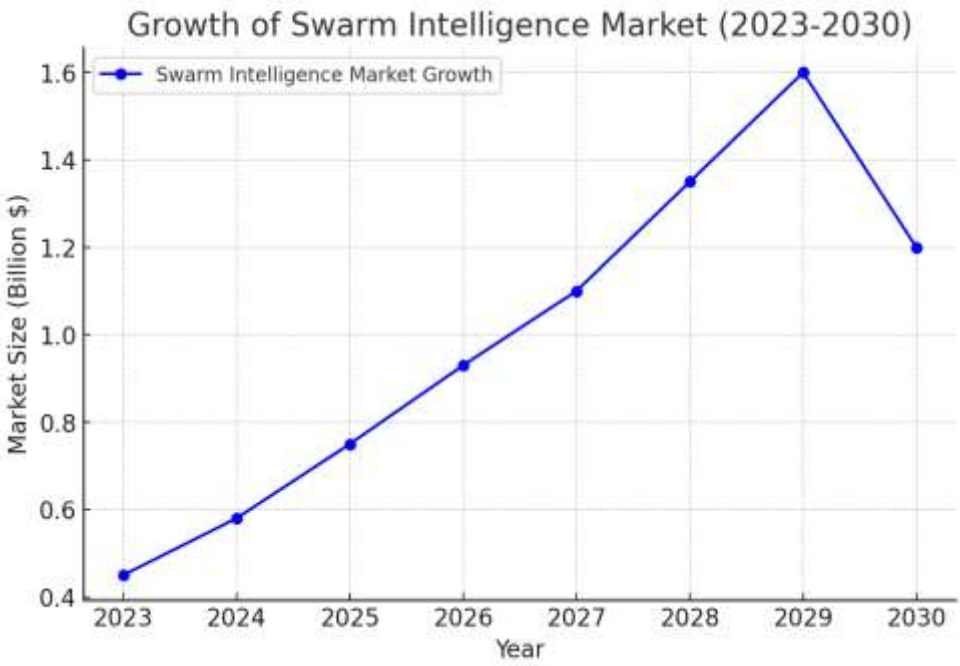


Fig. 4: Growth of Swarm Intelligence Market

Swarm Intelligence holds immense potential for making smart homes more autonomous, secure, and energy-efficient. By overcoming existing challenges and leveraging emerging technologies, SI can lead the next wave of intelligent home automation.

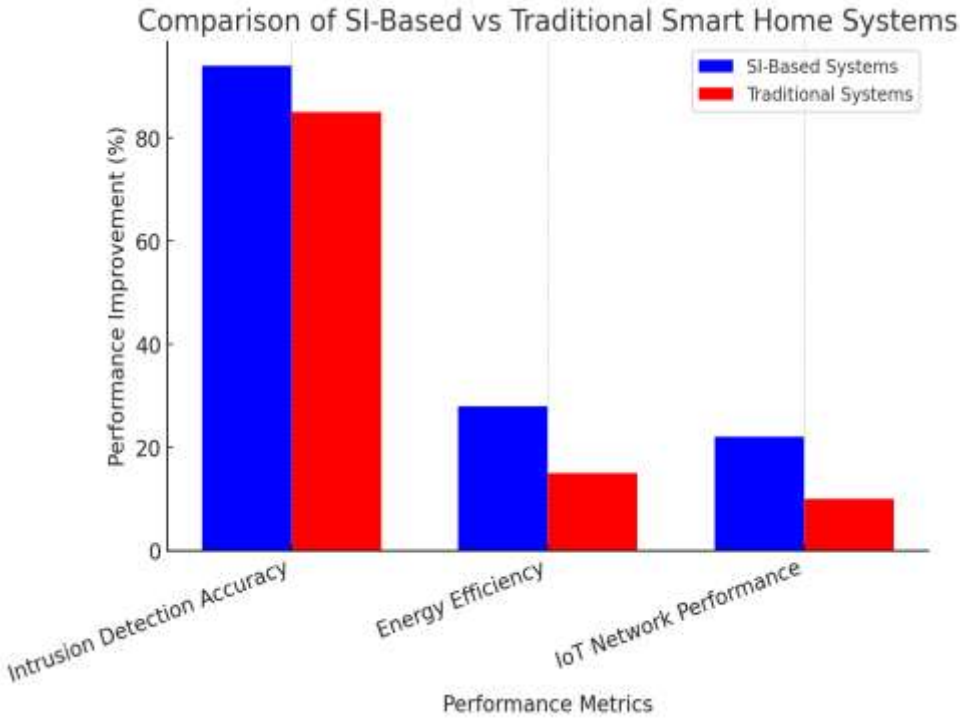


Fig. 5: Comparison of SI-based vs Traditional Smart Home Systems

Fig. 4 and 5 showing the projected growth of the Swarm Intelligence market from 2023 to 2030. The market is expected to increase significantly due to the adoption of SI in smart home applications.

Conclusion

Swarm Intelligence presents a promising paradigm for enhancing smart home efficiency, security, and adaptability. By leveraging decentralized decision-making and emergent behaviors, SI enables intelligent resource allocation, robust security mechanisms, and seamless automation. Through applications in energy management, home security, adaptive environmental control, and decision-making, SI-driven smart homes are transforming daily life. Despite challenges such as computational complexity, security concerns, and standardization issues, ongoing advancements in AI, edge computing, and IoT will continue to refine and enhance SI applications. The integration of SI with technologies like 5G, blockchain, and quantum computing is expected to further improve smart home automation, leading to more resilient, self-adaptive, and user-friendly systems. Future research should focus on enhancing human-SI interaction, improving security frameworks, and optimizing SI-based automation for real-world smart home environments.

References

Sepasgozar, S., Karimi, R., Farahzadi, L., Moezzi, F., Shirowzhan, S., M. Ebrahimzadeh, S., & Aye, L. (2020). A systematic content review of artificial intelligence and the internet of things applications in smart home. *Applied Sciences*, *10*(9), 3074. https://doi.org/10.3390/app10093074

Cottone, P., Gaglio, S., Re, G. L., & Ortolani, M. (2015). User activity recognition for energy saving in smart homes. *Pervasive and Mobile Computing*, *16*, 156-170. https://doi.org/10.1016/j.pmcj.2014.08.006

Saad al-sumaiti, A., Ahmed, M. H., & Salama, M. M. (2014). Smart home activities: A literature review. *Electric Power Components and Systems*, *42*(3-4), 294-305. https://doi.org/10.1080/15325008.2013.832439

Thakkar, A., & Chaudhari, K. (2021). A comprehensive survey on portfolio optimization, stock price and trend prediction using particle swarm optimization. *Archives of Computational Methods in Engineering*, *28*(4), 2133-2164. https://doi.org/10.1007/s11831-020-09448-8

Du, Y., Lim, Y., & Tan, Y. (2019). A novel human activity recognition and prediction in smart home based on interaction. *Sensors*, *19*(20), 4474. https://doi.org/10.3390/s19204474

Alam, M. R., St-Hilaire, M., & Kunz, T. (2017). An optimal P2P energy trading model for smart homes in the smart grid. *Energy Efficiency*, *10*, 1475-1493. https://doi.org/10.1007/s12053-017-9532-5

Alam, M. R., Reaz, M. B. I., & Ali, M. M. (2011). SPEED: An inhabitant activity prediction algorithm for smart homes. *IEEE Transactions on Systems, Man, and Cybernetics-Part A: Systems and Humans*, *42*(4), 985-990. https://doi.org/10.1109/TSMCA.2011.2173568

Wu, S., Rendall, J. B., Smith, M. J., Zhu, S., Xu, J., Wang, H., & Qin, P. (2017). Survey on prediction algorithms in smart homes. *IEEE Internet of Things Journal*, *4*(3), 636-644. https://doi.org/10.1109/JIOT.2017.2668061