IMPROVING HOME SECURITY USING BLOCKCHAIN

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ABSTRACT

The major problem with the use of smart home technology is that it often leads to various security issues. This mainly happens because the devices use open internet connections that may be vulnerable and subjected to multiple threats, hackers, and viruses. Some household IoT devices are forcefully introduced to the market, exposing the customers to significant risk factors. The websites and links do not have any copyright information or any privacy policies, due to which the hackers may immediately steal the confidential information of the user. For instance, the door locking password may be hacked by cyber criminals, and they may use it to attack the home when there is nobody in the home. This paper presents how to use block-chain to improve home security.

Keywords: Home Security, Blockchain, Internet of Things.

INTRODUCTION

The entire population is now getting revolutionized into tech-savvy functions and activities in today's digital world. With the advancement of technological devices in every tiny aspect of life, people are growing more innovative and more intelligent day-by-day in performing their regular essential activities. In recent years, innovative home technology has become one of the most useful and advancing trends. Reports confirm that around 37.5% of the world's population has already adopted smart home technologies in performing their domestic activities such as operating the television, door locking, heating, and lighting [1]. The technology is controlled by the Internet of Things (IoT), through which any device in a smart home can be connected to a single controller. The controller would control multiple things simultaneously, one of the most significant advantages of smart home technology. This is essentially important for regular busy professionals, who cannot manage enough time for household activities [2]. The user gets controlled over everything, from wifi and TV to electricity, equipment handling, etc. When the house and devices are connected to a single network, it becomes easier for people to perform the essential activities and enjoy a happy life. The users need to install a smart home app on their mobile devices, which will help them operate the smart home equipment (Oliveira et al. 2020). As a result, the user will get efficient energy consumption, improved security of the devices, convenience, and comfort. Smart home technology is also known as domotics or home automation, derived from the Latin word 'Domus' meaning home. The equipment and systems of innovative home technology are linked

to IoT, which helps the users constantly communicate with the devices, exchange automated activities, and consumer use data as per their own decisions [1]. However, the technology has one major drawback connecting the devices with the internet, leading to significant security issues and problems for the owner. This report will discuss the impact of using blockchain technology in reducing hacking in smart homes to resolve security issues related to the use of smart devices.

Problem definition

It has been reported that nearly 35% of smart house owners have encountered major security concerns occurring due to information breaching [4,5,6]. More than 40% of smart house devices are prone to cyber-attacks, and around 65% of savvy home users do not have sufficient innovative support systems to protect their privacy and security. In the absence of adequate protection, it is not only the (IoT) data subjected to a significant compromise by the hacker ([2]. The criminals can also easily access the user's social media accounts, bank accounts, emails, and other essential and confidential information. Smart home devices are also related to various technical issues that may cause these security issues to arise. For instance, if the user faces significant connection problems, from their smartphones to domestic devices, they will most likely be no longer able to control the smart home device any further [9,12,13,14]. As a result, the device may again be highly exposed to huge threats and cyber-attack risks. Even if users realize that their data is getting stolen, they cannot do anything about it, as they do not have any control over the device due to technical errors.

Proposed solution

One of the best ideas to solve the security and hacking issues of smart home devices is blockchain technology. Current research has shown that blockchain devices are the most reliable and robust security mechanisms that can be used for various purposes; one of them is meeting security issues [6,7]. With the increased use of smart home devices globally, blockchain devices are also gaining significant importance in the market. The solution works by effectively securing the critical information on a particular blockchain device that can also be widely implemented on a range of information platforms if required [3]. This is more essential when it comes to using multiple smart home devices at the same time. The blockchain technology (if installed by the owner) will simultaneously help protect the essential data of all the smart home devices that are currently connected to the IoT and are used by the owner). The tools detect the blockchain ecosystem, analyze the risk factors and threats to apps, data, and various other digital assets that are connected. The blockchain technology system decentralizes the management systems of the connected devices (that is, the Domain Name System or DNS entries) [7]. This helps reduce the associated assaults of the Distributed Denial of Services (DDoS). Apart from this, blockchain devices also help protect the information to be accessed by unauthorized third parties during its transition or encryption. It helps store the data over a network of computers, making the hacking process much more complex and time-consuming [9] With the installation of blockchain technology, hacking is only possible when the entire network is compromised instead of a single server. The hacker needs to connect every stem simultaneously to affect the whole networking system. Despite having the most experienced hacker in the team, this is nearly impossible.

Related work

Past works	Authors	Methods used
IoT-based smart homes: A review of system architecture, software, communications, privacy, and security	Mocrii *et al.* [11]	To mitigate the security issues faced in smart homes, the method used in IoT is to gather information regarding system architecture, communications, software, security, and privacy.
Blockchain for smart homes: Review of current trends and research challenges	● Moniruzzaman *et al.* [10]	This article has used a P2P energy trading platform that is blockchain-based. This was implemented in the laboratory by the authors.
Investigating Smart Home Security: Is Blockchain the Answer?	● Arif *et al[9]*	To operate the safety in the smart home, the homeowners are given access to wireless connectivity Sensors of the home appliances, which can be gained from sensors.
Multiple cloud storage mechanisms based on blockchain in smart homes	Ren *et al.* [8]	To improve the efficiency of the signature verification, this article focuses on an identity-based proxy aggregate signature.

There are several problems that Trivodaliev and Risteska-Stojkoska have identified in IoT smart homes. The authors state that it is integral to optimise communication in the area of edge computing among the SH devices. Among the devices, they state that lightweight algorithms can be developed for local data processing and a reduction in the number of transmissions among the devices. The storage and integration of the data collected from the devices must be transferred into big data approaches. Smart homes are no longer considered to be the domain of science fiction.

Moniruzzaman *et al.* [10] stated that for smart home applications, the opening of new avenues is the potential of blockchain technology. However, before adopting blockchain technology to main security in smart homes, further investigation of the mainstream is very necessary. The advancement made in communication and information technologies triggers a

transition under the ecosystem of IoT smart homes. Ensuring security and privacy is a serious issue faced by smart home applications. Due to this, blockchain technology could be the best solution for these issues.

However, Arif *et al.* [6,60,61] stated that a decentralised database had been introduced with cryptographic techniques known as the blockchain to ensure security within the IoT smart homes. The blockchain framework is considered the substitute for centralised models under the IoT systems. However, these species contain few concerns that can meet smart home security.

Various issues are faced by smart homes to maintain security. However, to improve the efficiency of the signature verification [62,63,64,65,66,67], Ren *et al.* focus on an identity-based proxy aggregate signature along with reduction of communication bandwidth and compression of storage space. From the research that has been conducted in this research, it has been evaluated that compared to that of the ordinary signature scheme, the communication cost of identity-based proxy aggregate signature is 12% to 39%. However, the storage performance is superior since the performance is better than 20% of the blockchain itself in identity-based proxy aggregate signature [52,53,54,55,56,57,58].

METHODOLOGY

Various methods are used in this research to gather the necessary information. These are as follows: -

Research philosophy

With the help of which data is collected within the research, the belief is termed as research philosophy. There are three types of research philosophies: positivism, interpretivism, and realism. In this research, the researcher has used the interpretivism philosophy. The researcher in this research has collected secondary data. The data collected by him were interpreted and jotted down to the audience ([7,8,9,49,50,51]. Under the interpretivism, there is a specific role of the researcher which includes observing the social world before deriving any conclusions [22,23,24].

Research approach

The plan with the help of which the entire data for the research is collected and analysed is known as the research approach. There are two types of research approaches. These are indicative approaches and deductive approaches. The researcher has used the deductive approach [13] This means that no new theory was induced by him and can be derived from existing researchers. Under the deductive method, information is deduced from past research [45,46,47].

Research design

The framework with the help of which the entire data for the research is collected and analysed is known as research design. There are five types of research design. These are

explanatory, exploratory, diagnostic, descriptive and correlational. In this research, the researcher has used the explanatory research design. With the limited information gained by the researchers, the main reason for the occurrence of issues in smart homes has been identified [14]. This method is also known as the cause and effect method, where the researcher has evaluated the causes of issues in smart homes along with the outcomes received. However, according to a few researchers, this design is also used to identify the loopholes of the research within this given topic [25,26,27].

Data collection technique

Data collection techniques are the procedure with the help of which the data for the specific research is collected. There are two methods of data collection. These are the primary method and secondary method [47,47,48,49]. The primary method is divided into two parts: the qualitative and quantitative methods [15,68,69]. In this research, the researcher has used the secondary method. This means that the researcher used the data from the existing research. No new theories have been derived.

Ethics

To conduct research, various ethics have to be maintained. In secondary research, the researcher ensures that he gathers existing data. However, he must ensure that these data are not modified and changed. The exact findings have to be stated in the research. Under the Data Protection Act 1998, keeping the data safe and secure is necessary. No data can be disclosed before the publication of the research [31,32,33]. The privacy of the data is in the hands of the researcher. The researcher also has to ensure social responsibility. This means that no data can be published in a manner that can harm society or a specific group of people [39,40,41,42,43].

CONCLUSIONS

IoT products and the use of smart home appliances has become common in the last decade, however there is not much discussion on the security of those devices [34,35,36]. Therefore, the emergence of Blockchain technology has become one of the most reliable security measures for smart homes. The blockchain technology provides a simple and straightforward solution for any IoT related devices, it allows the homeowners to securely control every security aspect of smart homes [10]. Controlling a simple function such as turning a switch on or off and controlling complicated hardwares such as door locks, house lighting, smart locks etc. can be done securely using the blockchain technology[37,38].

The research focuses on the emerging threats of using IoT devices in smart homes, the IoT devices in the market are not perfect and could be compromised easily by hackers. Due to the security flaw in the IoT devices, the hackers can access the private network of the homeowners without them being aware of the breach. The homeowners are prone to threats such as information leaks, malware invasion, data and identity theft, service denial and execution failure [11]. These threats have become an alarming issue for the smart home owners, that is 37.5% of the entire world population. Thus, the research sheds light on the use of blockchain technology in smart homes and how this technology helps to improve the security. The research elaborates how blockchain technology has benefited the digital universe by providing a robust cybersecurity protocol [10]. The technology has been used in the

cryptocurrency market making cryptocurrency transactions secure and unhackable. Pondering on the effectiveness of blockchain technology in cybersecurity, the technology is also being incorporated in smart home networks and IoT devices.

The research has found that among all the cybersecurity technologies used by smart homeowners, blockchain has emerged as the most secure technology in the digital universe. Security breaches such as unauthorised access, data leaks, identity theft, etc. have become nearly impossible by hackers [9] The research also found that the technology uses a decentralised data system, meaning that the information on the private network of homeowners is spread over numerous servers instead of being in a single server network. It significantly reduces the changes of security networks being compromised thus helping to improve smart home security [9].

The research has provided information on how the blockchain technology will benefit smart homeowners to improve their security measures. However, the technology has a broader application in terms of cybersecurity. The technology can be used in other industries to improve the cyber security, the technology can be applied in banking industries, agriculture industry, education, healthcare, accounting etc [9]. The industries will significantly benefit by incorporating blockchain technology as it will improve the network security measures. The research helps to understand the importance and advantages of blockchain technology, moreover it also highlights how users of the technology have benefited from it. Hence, it can be concluded that blockchain technology has great potential to improve the cybersecurity of not only smart homes but also numerous other industries [10].

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