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Unraveling the Dynamics of User Acceptance on the Internet of Things: A Systematic Literature Review on the Theories and Elements of Acceptance and Adoption

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Abstract: - The Internet of Things (IoT) connects various devices to the internet, enabling seamless communication and coordination. Its sensor and action capabilities aid in early fire detection and response. This article investigates the theory and elements of Internet of Things (IoT) acceptance and acceptance to see how IoT can assist in monitoring and controlling fire safety management. This study uses a systematic literature review (SLR) methodology to search, identify, appraise, synthesize, analyze, and summarize studies on the Internet of Things (IoT). The study highlights the importance of theoretical frameworks like TPB, TAM, UTAUT, and TOE in understanding the Internet of Things (IoT) acceptance and adoption. TPB focuses on attitudes, subjective standards, and perceived behavioral control, TAM emphasizes ease of use, UTAUT focuses on performance expectancy, effort expectancy, social influence, and facilitating conditions, and TOE examines organizational, technological, and environmental aspects affecting commercial IoT adoption. These frameworks provide actionable insights for successful IoT implementation and integration in individual and organizational settings.

Keywords: Internet of Things, acceptance, adoption, IoT.

I. INTRODUCTION

Fires, with their devastating potential, pose a multidimensional threat, threatening lives, property, and economic stability. Aside from the direct impact on persons and communities, flames contribute to environmental degradation and air pollution, heightening the need for comprehensive solutions to counteract their devastation. As noted by Khan [1], early detection and response to fires is critical in limiting the harm caused by these accidents. The Internet of Things, a paradigm shifts since 1990's [2], has matured into a technical powerhouse, connecting a wide range of things to the Internet. The Internet of Things (IoT) enables seamless communication and coordination amongst these things by utilizing wireless and wired technologies, endowing them with sensory and action capabilities. Initially used in non- stress applications such as global supply chain management and environmental monitoring [3], the IoT has demonstrated its versatility and adaptability. One of the crucial areas where IoT may have a large impact is in disaster management, where it can provide novel solutions to improve early warning systems and reaction processes. This article investigates the theory and elements of Internet of Things (IoT) acceptance and acceptance to see how IoT can assist in monitoring and controlling fire safety management.

II. METHODOLOGY

A literature review is a fundamental component of academic research. Knowledge advancement must, at its core, be constructed upon preexisting research. Through a review of relevant literature, the scope and depth of the existing body of work is assessed and identify the gap for future research work. This study adopts a common SLR methodology which consists of searching, identification, appraisal, synthesis, analysis, and summary of studies [4]. Regarding the SLR process, the first step is searching using the keywords identified based on the topic and research objectives. The literature is searched within Scopus, Google Scholar, and Web of Science (WoS), with limit to journal articles only. The inclusion criteria were as follows: (1) English articles, (2)

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journal articles only, and (3) the theories or models of acceptance or adoption of IoT. The target journal articles consist of keywords of “Internet of Things”, “IoT”, “IoT adoption”, “Technology acceptance”, “User acceptance” OR “Consumer acceptance. Based on the search, 356 journal articles match the first criteria selection. The review excluded irrelevant journal articles through two stages which are screening the title and abstract of the publications and a full review of the publications. Journal that consists of duplication, incomplete information, irrelevant with the topic are removes which left to 107 journal articles to be criticize. Among 107 journal articles, 37 journal articles were included for SLR as these journal articles complied with the criteria and met the objectives of this paper (see Table 1).

Table 1. Summary of Database Screening

Databased Source	**Year**	**Keywords**	**Screening Result**
Scopus		“Internet of Things” “IoT”	Identification n=141 Screening n = 39 Included n =14
Web of Science (WoS)	2018 - 2024	“IoT adoption” “Technology acceptance”	Identification n=127 Screening n = 43
Google Scholar		“User acceptance” OR “Consumer acceptance”	Identification n=88 Screening n = 25
			Identification n=356 Screening n = 107 Included n =37

Where n is the number of journal articles

III. THEORIES ON THE INTERNET OF THINGS (IOT) STUDIES

A. Theory of Planned Behavior (TPB)

The Theory of Reasoned Action (TRA), first presented by Ajzen & Fishbein [5], is largely superseded by the Theory of Planned Behavior (TPB). The core element of TPB is that behavior is mostly determined by behavioral intention [6]. TPB adds a fresh feature called perceived behavioral control while keeping the elements of behavioral attitude and subjective norms from TRA. PBC measures how someone feels about the impact of opportunities, resources, and abilities on their capacity to reach goals. According to TPB, a person's behavioral intention is shaped indirectly by their behavioral attitude and subjective norms [5]. Through these intents, perceived behavioral control simultaneously influences behavior directly and indirectly.

The perceived behavioral control (PBC) construct is incorporated into TPB to identify situations in which people may not have total control over their actions [7] asserts that behavioral intention is a crucial indicator of a person's propensity to participate in a particular behavior. The formulation of behavioral intention is influenced by two factors [8]: subjective norm, which indicates perceived social or organizational pressure, and attitude, which expresses how much a person evaluates the behavior favorably or unfavorably. Perceived behavioral control, or PBC, is the third antecedent and represents an individual's assessment of how easy or difficult the behavior is to complete. The dynamic aspect of these predictors is emphasized by Ajzen [7], who points out that the relative weights of attitude, subjective norm, and PBC can change depending on the behavior and circumstance.

Thus, TPB's three key components influencing behavioral intention are attitude, subjective norms, and perceived behavioral control. In conclusion, the TPB provides a comprehensive framework for understanding and predicting human behavior. TPB emphasizes behavior intention as a key aspect in influencing actual behavior, integrating behavioral attitude, subjective standards, and perceived behavioral control. These aspects influence a person's intention to engage in a certain behavior, with perceived behavioral control deciding how likely they are to achieve their aims. As Ajzen noted, these predictors' dynamic nature shows TPB's adaptability to various behaviors and situations. Overall, TPB gives informative information on human behavior variables and is beneficial for studying the Internet of Things and other domains.

B. Technology Acceptance Model (TAM)

The Technology Acceptability Model (TAM) is a popular paradigm for studying technology acceptance and adoption. TAM evolved from the Theory of Reasoned Action (TRA) [9], retaining the TRA's attitude toward technology while excluding the social influence component. TAM is based on behavioral intention (BI) [10], which is influenced by one's attitude toward technology. TAM presented two critical belief factors: perceived usefulness (PU) and perceived ease of use (PEoU) [11], both of which have a substantial impact on an individual's attitude. PU represents a person's belief that utilizing a given technology will improve their performance, whereas PEoU measures the perceived ease of use of that technology. TAM detects external influences influencing attitudes, and TAM2 was proposed to solve its weaknesses by including dimensions such as subjective norms and cognitive elements. Following that, TAM3 evolved, which included additional elements influencing perceived ease of use, such as anchors (beliefs about technology use) and modifications (beliefs derived from direct technology experience) [12]. The Technology Acceptance Model (TAM) was introduced in 1986, focusing on Information Systems (IS) consumption and its impact on attitudes and behavioral intentions towards IoT usage. TAM, which emphasizes perceived ease of use and perceived usefulness, has been shown to have greater explanatory power than TRA and PBT, making it particularly suitable for online and technology work.

In conclusion, the Technology Acceptance Model (TAM) is a reliable tool for predicting technology adoption. Its progress through TAM2 and TAM3 indicates its commitment to increasing its prediction and adaptability. In the wide world of the Internet of Things (IoT), TAM helps us understand how people behave in this shifting and linked environment. IoT studies utilizing TAM principles assist academics and practitioners to assess technology acceptance by concentrating on usefulness and ease of use. TAM's long-term utility and versatility make it an important tool for figuring out how to convince users to adopt new technologies in this ever-evolving area. In IoT research, TAM helps us understand how user attitudes, behavioral intentions, and networked technology adoption interact in complicated ways. This allows us to brainstorm clever IoT innovation application and integration strategies.

C. Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT), conceived by Venkatesh and Morris [13], amalgamates constructs from previous acceptance theories, yielding a comprehensive model for understanding users' behavioral intention to accept new technologies. This theory encompasses four pivotal factors influencing acceptance: effort expectancy, performance expectancy, social influence, and facilitating conditions [14]. Researchers commonly leverage UTAUT in assessing new technologies, often emphasizing performance and effort as critical factors. Aligning with TAM principles, UTAUT explores perceived usefulness and ease of use. In the context of the Internet of Things (IoT), UTAUT's versatility is showcased as it has been employed to analyze factors influencing users' intentions regarding the usage of internet things. The UTAUT framework's adaptability underscores its relevance in elucidating user acceptance dynamics within the dynamic IoT landscape.

UTAUT's efficacy extends to many sectors, including the building and construction such as in fire hazard safety and management [15]. The model's core variables— performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FC)— directly predict behavioral intention (BI) and actual usage [14]. In the context of IoT, this model becomes particularly relevant as it enables a comprehensive examination of factors influencing users' behavioral intentions towards connected healthcare devices. Beyond the initial UTAUT variables, researchers explore additional dimensions related to users' personal traits, technological knowledge, and data disclosure, providing a holistic understanding of technology adoption within the evolving landscape of the Internet of Things.

The Unified Theory of Acceptance and Use of Technology (UTAUT) has been adapted to address the unique challenges and opportunities of the Internet of Things (IoT). Performance Expectancy, which focuses on the added value and utility of IoT applications, plays a crucial role in shaping users' attitudes and intentions towards adopting and using these technologies. Users evaluate the potential advantages of IoT in terms of efficiency, productivity, and convenience. Effort Expectancy, which revolves around the ease of use and simplicity of interacting with interconnected devices, is also crucial in mitigating potential barriers to adoption. Social influence, which extends beyond traditional spheres to the digital realm, also plays a significant role in IoT adoption. Finally, facilitating conditions, such as technical support, infrastructure availability, and organizational policies, play a pivotal role in shaping users' acceptance of IoT technologies.

D. Technology-Organization-Environment Framework (TOE)

The Technology – Organization – Environment Framework (TOE) provides a robust and encompassing framework for comprehending the intricate process of technology adoption within organizational contexts, particularly when applied to the expansive domain of the Internet of Things (IoT). Adapting TOE to IoT necessitates a nuanced exploration of organizational, technological, and environmental factors [16], each playing a pivotal role in shaping the landscape of technology integration. Within the organizational realm, IoT adoption hinges on an in-depth examination of a firm's preparedness to embrace and integrate IoT technologies seamlessly. This involves scrutinizing the organizational structure, understanding the cultural dynamics, and assessing the adaptability of existing processes to incorporate and accommodate the implementation of IoT solutions [16]. The successful integration of IoT within an organization requires a cohesive alignment with its existing structures and operations, emphasizing the need for a strategic approach that considers not only the technological aspects but also the human and procedural dimensions. Moving to technological factors, the application of TOE principles to IoT involves a thorough assessment of the sophistication and compatibility of IoT solutions [17]. This evaluation extends to considerations of the existing technological infrastructure, examining the scalability of IoT implementations, and ensuring compatibility with the organization's current systems. Addressing these technological aspects is paramount for the effective adoption of IoT technologies, as it directly influences the performance, interoperability, and long-term sustainability of IoT solutions within an organizational setting.

Simultaneously, environmental factors are integral to the broader adoption of IoT technologies [3]. These external conditions encompass regulatory frameworks, economic conditions, and market dynamics, which collectively shape organizations' decisions to invest in and adopt IoT technologies. Understanding and navigating these external influences are critical for organizations seeking to position themselves strategically in the evolving landscape of IoT. By taking a proactive approach to comprehend and adapt to these environmental factors, organizations can better position themselves for successful and sustainable IoT adoption [16]. In conclusion, the adaptation of the Technology – Organization – Environment Framework (TOE) to the Internet of Things involves a holistic exploration of organizational, technological, and environmental dimensions. This comprehensive framework offers valuable insights for organizations navigating the dynamic landscape of technology adoption. By considering factors ranging from internal readiness and technological infrastructure to external influences, organizations can make informed decisions that foster successful and sustainable IoT adoption. The application of TOE principles provides a structured approach to understanding and addressing the complexities inherent in integrating IoT technologies into organizational frameworks, ultimately contributing to the evolution and advancement of the digital ecosystem.

E. IoT and Theories in Previous Studies

The study of Internet of Things (IoT) utilizes a diverse range of theoretical frameworks to comprehend and examine the intricacies involved in its acceptance and application (see Table 2). The main theoretical stances that have influenced research efforts in this ever-changing field are examined in this introduction. The Theory of Planned Behavior (TPB) explores the role of attitudes, subjective norms, and perceived behavioral control on individuals' intentions to embrace IoT. While the Unified Theory of Adoption and Use of Technology (UTAUT) incorporate several factors of technology acceptance, the Technology Acceptance Model (TAM) investigates user acceptance of technology. The Technology–Organization–Environment Framework (TOE), which looks at organizational issues influencing technology adoption, offers a thorough perspective. The Innovation Diffusion Theory (IDT) looks at how innovations spread across a social system, whereas the Value-based Adoption Model (VAM) explores how values fit with technological choices. Consumer Perceived Innovativeness (CPI) measures people's propensity to accept new technologies, whereas Task Technology Fit (TTF) looks at how well technology works with particular tasks. Scholars are guided through the intricate interplay between technology and human behavior in the networked world by means of this collection, which provides a foundation for comprehending the vast theoretical terrain that supports Internet of Things research.

Table 2. IoT and Theories

Author (Year)	Theory							
	TAM	**UTAUT**	**TOE**	**TPB**	**VAM**	**CPI**	**TTF**	**IDT**
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The Theory of Planned Behavior (TPB) is a fundamental framework for understanding individual behavior, including attitudes, subjective norms, and perceived behavioral control. In the context of the Internet of Things (IoT), TPB is applied to understand users' acceptance and acceptance of IoT. Attitudes are influenced by perceived benefits, while subjective norms extend beyond traditional social circles to virtual communities. Perceived behavioral control in IoT involves users' ability to manage complex networks, considering technological literacy and perceived control within the IoT ecosystem [37],[42],[51]. Furthermore, the Technology Acceptance Model (TAM) is crucial in understanding technology adoption, focusing on perceived ease of use and usefulness. Adapting TAM such as in the studies [20] [28], [30], [32], [34], [43], [50],[52], and [54] of IoT involves broadening these core concepts to include interconnected devices, system reliability, data security, and interoperability. On the other hand, the Unified Theory of Acceptance and Use of Technology (UTAUT) requires adaptation for the unique challenges and opportunities presented by the IoT landscape [18], [31], [35], [42], [47], and [53]. In addition, [20] and [33] elaborate that TOE offers a comprehensive framework for understanding technology adoption within organizations, exploring organizational factors such as readiness, structure, culture, technological factors, and environmental factors. The Value-based Adoption Model (VAM) emphasizes the perceived value users associate with IoT technologies, while the Innovation Diffusion Theory (IDT) helps understand how innovations spread within a society or organization has been mentioned in the studies by [21], [23], and [42]. The Innovation Diffusion Theory (IDT) [20] [24] [34], Consumer Perceived Innovativeness (CPI) [34], and Task Technology Fit (TTF) [38] are an additional theory used to understand the IoT adoption and users acceptance. IDT identifies factors such as innovation attributes, communication channels, and social systems, while CPI captures users' openness to explore and adopt IoT innovations. TTF assesses the alignment between technology and specific tasks, focusing on factors like usability, compatibility, and task performance. Understanding these factors is crucial for successful IoT integration into various contexts, including personal and organizational setting.

IV. ELEMENTS OF ACCEPTANCE AND ADOPTION ON THE INTERNET OF THINGS (IoT) STUDIES

In the exploration of the elements influencing the acceptance and adoption of Internet of Things (IoT) (see Table 3), a comprehensive categorization based on prominent theoretical frameworks unfolds. Grounded in the Theory of Planned Behavior (TPB), elements such as attitude, subjective norm, perceived behavioral control, feedback, perceived risk, and perceived value delve into the psychological dimensions that shape individuals' inclinations towards IoT. Likewise, the Technology Acceptance Model (TAM) is reflected in elements like perceived usefulness, perceived ease of use, innovation, security, and support system, highlighting the pivotal role of user perception in technology adoption. The Technology – Organization – Environment Framework (TOE) encompasses organizational and environmental factors, alongside considerations like task technology, connectedness, efficiency, functionality, service quality, financial cost, perceived innovation, and innovation security, offering a comprehensive framework that integrates diverse dimensions. Complementing these theories, the Unified Theory of Acceptance and Use of Technology (UTAUT) informs elements like performance expectancy, effort expectancy, social electronic word of mouth, facilitating condition, digital dexterity, and compactability, weaving together social, contextual, and user-related factors. This intricate categorization underscores the interconnectedness of psychological, social, organizational, and technological facets in shaping the landscape of IoT acceptance.

Several commonalities emerge across the studies, signifying shared trends and determinants in the acceptance and adoption of the Internet of Things (IoT). Notably, the studies by [18], [19], [20], [21], and [22] collectively underscore the significance of perceived usefulness as a pivotal factor influencing IoT adoption. Whether through examining performance expectancy, eco-effective feedback, or perceived value, the studies consistently emphasize the crucial role of users perceiving tangible benefits and value in IoT technologies. Moreover, privacy concerns emerge as a recurrent theme, with [19] and [21] explicitly addressing the adverse impact of privacy issues on IoT adoption. Both studies stress the importance of mitigating these concerns to foster a positive environment for users considering the integration of IoT-based solutions. Additionally, [19] and [24] delve into the barriers hindering IoT adoption, with both studies identifying technological awareness and perceived convenience as influential determinants.

[24] Further extend their analysis to include factors against adoption, such as image barrier and technological anxiety, demonstrating a holistic perspective on the challenges faced in promoting IoT acceptance. Furthermore, the exploration of social influence emerges in multiple studies, with [18], [22], and [24] all considering it as a determinant in their investigations. This emphasis underscores the broader social dynamics that play a role in shaping individuals' attitudes and intentions towards adopting IoT technologies. In summary, the convergence of findings across these studies highlights the recurring importance of perceived usefulness, privacy concerns, established theoretical models, and social influence in understanding the complex landscape of IoT adoption. These shared insights collectively contribute to a more comprehensive understanding that can guide practitioners, policymakers, and researchers in fostering a conducive environment for the widespread acceptance of IoT technologies.

[27] Underscore the importance of perceived ease of use in influencing attitudes towards the InaRISK BNPB platform for disaster management, emphasizing the significance of usability and intuitiveness for technology acceptance. Aligning with this, [28] in the context of smart home environments identify key determinants such as compatibility, connectedness, and control, highlighting positive motivations, while also acknowledging cost as a negative hindrance to adoption. A parallel emphasis on factors like perceived ease of use and perceived usefulness is evident in studies by [30], [31], and [32], indicating the consistent role of these elements in shaping user perceptions and intentions. Furthermore, [29] and [31] introduce social influence, performance expectancy, and habit as contributing factors, showcasing the multifaceted nature of influences on IoT acceptance. Privacy concerns, a recurrent theme, are addressed by [35], emphasizing the importance of trust and data security.

[36] Extends the exploration to price value and effort expectancy. Collectively, these studies provide a comprehensive perspective on the elements influencing IoT adoption, underscoring the intricate interplay of usability, motivations, social factors, and privacy considerations that contribute to the acceptance and adoption of IoT technologies across diverse contexts.

[39] and [41] both delve into the importance of trust in technology, perceived usefulness, and perceived ease of use, indicating their pivotal roles in shaping attitudes and behavioral intentions towards smart mobility and technology adoption. Additionally, [44] and [46] echo the significance of trust, emphasizing its impact alongside factors like performance expectancy, habit, enjoyment, and perceived risks. [42] Identifies enjoyment and subjective norms as significant influencers on behavioral intention, aligning with [43] focus on perceived value and behavioral precursors. Furthermore, [40] and [45] explore motivations, with the former emphasizing convenience conditions and perceived trust. These collective insights underscore the intricate web of factors influencing IoT acceptance, ranging from trust and enjoyment to perceived usefulness, enriching our understanding of the multifaceted landscape of technology adoption.

[47] and [50] both underline the crucial role of trust in the adoption of IoT technologies, emphasizing its impact on users' perceptions of risk, usefulness, and ease of use. Additionally, [48] and [52] explore factors influencing practitioners' and individuals' willingness to adopt IoT, highlighting the significance of perceived usefulness, perceived ease of use, and trust. The study by [51] delves into mobility, security/privacy risk, and trust as influential factors in the adoption of IoT services. [53] Extend the exploration to cultural aspects and social influence, emphasizing variations in IoT adoption factors between India and the USA. [54] Contribute insights specific to the healthcare sector, emphasizing perceived ease of use and perceived usefulness in the implementation of a voice smart care system in hospital wards. Collectively, these studies enrich our understanding of the multifaceted factors shaping IoT acceptance, spanning trust, perceived usefulness, perceived ease of use, and contextual variations, offering valuable insights for designing and implementing successful IoT initiatives in diverse domains and cultural contexts.

Table 3. Elements of Acceptance and Adoption of IOT

[39]	[38]	[37]	[36]	[35]	[34]	[33]	[32]	[31]	[30]	[29]	[28]	[27]	[26]	[25]	[24]	[23	[22]	[21]	[20]	[19]	[18]	**Author (Year)**	
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Notes: PT - Perceived Trust, FB – Feedback, ATT – Attitude, SN - Subjective Norm, PBC - Perceived Behavioral Control, PR - Perceived Risk, PV - Perceived Value, PRI – Privacy, AUTO – Automation, PI - Perceived Innovation, MOB – Mobility, INOP – Interoperability, FC - Financial Cost, PE - Performance Expectancy, EE - Effort Expectancy, SI - Social Influence, FC - Facilitating Condition, MOT – Motivation, COMP – Compatibility, CONN – Connectedness, ANX – Anxiety, ENJ – Enjoyment, EFF – Efficiency, FUNC – Functionality, SEWOM - Social Electronic Word of Mouth, IC - Intrusiveness Concern, DD - Digital Dexterity, SQ - Service Quality, PU - Perceived Usefulness, PEOU - Perceived Ease of Use, PC - Perceived Convenience, INNO – Innovation, SEC – Security, SS - Support System, TTECH - Task Technology, HAB – Habit, ORG – Organization, ENV – Environment.

V. CONCLUSION

In conclusion, the adoption of theoretical frameworks such as TPB, TAM, UTAUT, and TOE in the context of the Internet of Things (IoT) involves a comprehensive exploration into the intricate dynamics of interconnected technologies, digital communities, and organizational ecosystems. Each framework contributes unique insights to understanding user behavior, attitudes, and organizational readiness within the rapidly evolving IoT landscape. Theoretical frameworks on IoT acceptance and adoption reveal the complex factors affecting this technological growth. With its focus on attitudes, subjective standards, and perceived behavioral control, the Theory of Planned Behavior (TPB) is essential for understanding networked gadgets and digital communities' changing social norms. The Technology Acceptance Model (TAM) emphasizes perceived ease of use and utility while expanding to include IoT system stability, data security, and interoperability. IoT adoption requires careful consideration of Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions, making the Unified Theory of Acceptance and Use of Technology (UTAUT) important. UTAUT's adaptability improves its efficacy by revealing user acceptability in the complex world of linked and intelligent gadgets. The Technology – Organization – Environment Framework (TOE) examines organizational, technological, and environmental aspects affecting commercial IoT adoption. TOE's application covers organizational preparedness, technological sophistication, and external variables, enabling IoT adoption prediction and understanding. In essence, these theoretical frameworks act as guiding compasses, increasing our understanding of the various factors impacting IoT adoption. These frameworks provide actionable insights that can inform successful implementation and integration of IoT technologies in both individual and organizational settings by recognizing and addressing the distinct factors inherent in interconnected technologies, digital communities, and organizational ecosystems. With the continuous evolution of the IoT environment, these frameworks furnish a solid foundation for policymakers, practitioners, and researchers to navigate the intricate complexities of adoption. This facilitates the realization of the complete potential of the IoT.

On the other hand, the incorporation of IoT represents a paradigm leap in the field of fire management. [55] Emphasize the potential of IoT in enabling regular and real-time building monitoring, resulting in a dynamic system capable of providing timely warnings and alarms in the face of growing fire dangers. Future research in the domain of IoT acceptance and adoption for fire safety management can embark on a longitudinal analysis to delve into the long-term user experience and satisfaction with implemented systems. This study would track the evolution of user attitudes, preferences, and concerns over time, offering valuable insights for continual system enhancement and optimization. Additionally, a cross- cultural examination could be undertaken to explore how cultural and regional variations influence the acceptance of IoT technologies in fire safety. Understanding these cultural nuances could inform the development of tailored strategies, ensuring the effectiveness of IoT implementations in diverse communities. Furthermore, a comparative assessment of different technological frameworks for IoT-based fire safety systems is crucial. This research should consider factors such as interoperability, scalability, and overall performance to provide insights into the most effective and adaptable solutions. Such comparative analyses can contribute to the establishment of standardized approaches and best practices for the widespread implementation of IoT technologies in fire safety.

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