

ADOPTION INTERNET OF THINGS ON ISLAMIC BOARDING SCHOOL: A SYSTEMATIC LITERATURE REVIEW

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Abstract:

Background: Internet of Things in Islamic boarding schools can become an embedded system that aims to expand the use of continuously connected internet connectivity. The importance of IoT modernization in Islamic education is because it eliminates skills gaps and lags. A brief comprehensive review is needed to help researchers and practitioners understand the adoption of internet of things on Islamic boarding school.

Purpose: This study aims to analyze and classify the literature on Internet of Things on Islamic Boarding school. Design/methodology by conducting literature studies published between 2017-2023 in the journal listed in the Journal Citation Report

Design/methodology/approach: This research is analyzed according to a systematic literature review approach involving interpretation-based assessments of research methodologies and critical findings in the study.

Findings/Result: The direction of this research is expected in the future to have implications for academics and practitioners. Internet of Things (IoT) brings the potential for significant disruption in various sectors, including education and places such as Islamic boarding schools.

Conclusion: Some of the problems and importance of IoT disruption for Islamic boarding schools include limited human resources where Islamic boarding schools may have limited resources, both in terms of finances and technological infrastructure. Implementing IoT technology requires initial investment and maintenance which can be an additional burden.

Originality/value (State of the art): IoT in Islamic boarding schools can become an embedded system that aims to expand the use of continuously connected internet connectivity. The importance of IoT modernization in Islamic education will eliminates skills gaps and lags in the education areas.

Keywords: internet of things, islamic boarding school, connectivity, systematic literature review

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INTRODUCTION

Technology advancements and societal shifts are causing a paradigm shift in Islamic residential schools. Islamic boarding schools are now far more knowledgeable about scientific developments and shifts. Three factors play a part in how Islamic boarding schools influence the moral development of the next generation: the supernatural, human, and environmental. The Islamic boarding school community's traditions and customs shape these dimensions (Chonitsa, 2018). Science and technology are causing rapid changes, so we need a system that can contribute and adapt. This change is seen in the growing acceptance of incorporating Islamic culture, values, and practices into educational settings in order to foster integration (Musaropah, 2018).

The history of Islamic education in Indonesia is very active. After Indonesian independence, three basic educational institutions emerged: madrasas, schools, and Islamic boarding schools. All three have experienced significant transformation over time (Ja'far, 2019). Students live in the Islamic boarding school environment with the kiai or Islamic boarding school administrators, in accordance with the structure implemented in the Islamic boarding school. Islamic Boarding School mostly consists of a recitation routine, which includes lectures, yellow book study, prayer, and other activities. It is thought that the existence of education in disruptive times can provide a new picture of Islamic da'wah activities.

Therefore, the need for digitalization in Islamic boarding schools is very important to preserve da'wah and offer solutions to current problems. Islamic boarding schools are able to survive throughout time and across generations because their educational model places high value on students in developing spirituality, morality and noble character. Islamic boarding schools must of course continue to apply various innovations and creativity in responding to the increasingly rapid developments in the modern era, including the digitalization of the IoT-based education system (Arif, 2019). Among the skepticism about the use of digitalization in Islamic boarding schools is that it affects the interaction and learning patterns of students. This has an impact on students' loss of politeness towards teachers. An additional factor is that digital media can eliminate the habit of face-to-face learning. Apart from that, the habit of looking for references through turot books can be replaced by the habit

of googling or staring at the screen. By encouraging students to be digitally literate, this negative impact can be reduced.

Teachers have this responsibility because of how quickly times are changing and new ideas are emerging every few seconds (Haris, 2023). In the context of Islamic boarding schools, "innovative terminology" refers to the application of fresh concepts and inventive ideas to raise the caliber of instruction, administration, and services provided. Innovation in Islamic boarding schools can support the establishment of strong traditional values while enhancing religious instruction, character development, and community empowerment. By involving IoT in Islamic boarding schools, it is hoped that Islamic boarding schools can increase their innovation. Some innovative terms that may be related to Islamic boarding schools in terms of creating services include technology-based education, Islamic boarding school management, innovative curriculum, environmental management, social media and communication. Innovation in Islamic boarding schools refers to the development of new ideas, concepts, or approaches that are implemented to improve the efficiency, quality, and positive impact of the services provided by Islamic boarding schools.

Islamic boarding schools are changing in terms of both their purpose and functioning. In addition to serving as a place of education and worship, it also serves as a hub or foundation for the following purposes: the study and advancement of Islam (*Ramatan li al-alam*), the creation of a culture of peace and tolerance, and community economic empowerment. In the future, Islamic boarding schools could offer a number of advantages and distinctive features related to curriculum, technology, and instructional strategies. The use of information technology in the classroom, including e-learning, online learning environments, and interactive teaching tools, is an example of technology integration in action. Use of technology to simplify Islamic boarding school administration and management. Islamic boarding schools can become centers of thought that are open to social change and prepare students to face the dynamics of society that continues to develop.

Islamic boarding schools are one of the oldest educational institutions in Indonesia, where the ecosystem includes the presence of Kyai/owners who are owners and also role models, figures, and respected

figures in Islamic boarding schools. As caregivers and providing education and teaching to their students, Kyai have a central role in an Islamic Boarding School. Apart from The ecosystem that exists within the Islamic boarding school, there are other ecosystems such as business units, alumni, management and teachers.

Because of its distinctiveness and qualities, Islamic boarding schools are regarded as a kind of education that plays a significant role in helping students develop their spirituality, which encompasses not just academic knowledge but also life's morals and values. Islamic boarding schools, on the other hand, are separated into three categories according to the curriculum: comprehensive Islamic boarding schools (combination), modern Islamic boarding schools (*Khalaf* or *Asriyah*), and traditional Islamic boarding schools (*Salafiyah*).

Islamic boarding schools can be divided into three categories based on the curriculum or educational system they employ: Traditional Islamic boarding schools (*salāf*). By teaching Arabic texts authored by experts in the fifteenth century, these Islamic boarding schools continue to exist in their original form. The method of instruction is the halaqah system, which involves reciting the Quran in the mosque. This implies that knowledge is restricted to that which the priests teach and does not progress toward full knowledge.

Buralnge and Misallkalr (2015) claim that the Internet of Things (IOT) is structured around objects, that individuals are given unique identities, and that in order to move data across the network, there must be two types of network-to-machine interfaces: source-to-destination and computer-to-computer. According to Keoh et al. (2014), the Internet of Things is a scientific advancement that uses sophisticated smartphone sensors that communicate directly via internet networks to optimize daily living. In 1990, John Romkey invented a device called a bread toaster that can be made digitally over the Internet since the internet became widely known in 1989 and became a daily activity.

The Internet of Things has become a technological revolution that has fundamentally transformed computers into communications, where digital development depends on dynamic technological innovations in many fields, from wireless sensors to digital technology. This technology is designed to

connect various types of objects in each signal device to a network in a large digital network. The problems of the Internet of Things have also been made easier by the developments that have occurred in telecommunication technology such as the introduction of wider capital, the new version of the IP V6 internet protocol, the integration of digital technology into many of the products in life's equipment. The concept of linking different components of the device to a web-managed network of digital devices and allowing users to interact with the software is consistent with the way educational technology has evolved, progressing from electronic learning (e-learning), to mobile learning (m-learning), and finally, to ubiquitous learning (u-learning). The primary attributes of u-learning include expanded digital access to educational materials in computer-supported collaborative learning spaces. By improving communication channels in interactions and turning digital traffic into digital traffic, digital with digital, and even digital with digital, the Internet of Things can, with its potential, help the process of digital learning. Regarding how the Internet of Things may be used to enhance the quality of education, particularly in the areas of digital technology, small things, mobile learning, and virtual reality.

Without the aid of a computer or human, the Internet of Things (IoT) application can transfer data across a network (Pangestu et al. 2020). Due to the extensive use of technical advancements, the Internet of Things (IoT) is currently undergoing numerous advancements (Nurkholis et al. 2017). Existing international networks and the internet of the future, which link real and virtual things via data collection and communication technologies, make up the Internet of Things (IoT) infrastructure. It is distinguished by a high degree of autonomy in data capture, event transfer, and network connectivity. It also provides object identification, sensor identification, and connection capabilities that serve as the foundation for the creation of independently established cooperative services and applications (Setiadi and Muhaemin, 2018).

According to Stallings (2015), the Internet of Things (IoT) is a worldwide infrastructure that uses advances in electronic hardware, software, sensors, and communication to link virtual and real items. In an infrastructure network like the internet, these physical devices function together (Stallings, 2015). By enhancing the knowledge practitioners and educators need to take the first steps or continue on their journey

to adopting the Internet of things for more strategic aims, this study is likely to benefit Islamic boarding schools.

IoT in Islamic boarding schools can become an embedded system that aims to expand the use of continuously connected internet connectivity. The importance of IoT modernization in Islamic education is because it eliminates skills gaps and lags (Syahansyah and Fatimatuzzahro, 2022). The concept of the Internet of Things emerges, when the structure of society is connected in an internet network, this is in accordance with the goal of IoT, namely improving communication between humans and between machines. So, concrete steps are needed in the form of an IoT-based adaptation model to improve the service performance of Islamic boarding schools in the future.

Participating in the Internet of Things (IoT) has become an important component in Islamic boarding school activities with its students (Pangestu et al. 2022). Human life is not disrupted by technology; on the contrary, technology helps society become better. Islamic boarding schools can maintain Islamic boarding school culture by adhering to good old traditions but must still accept changes that are more profitable. In this way, more insight will be gained to help Islamic boarding schools advance and develop. Nowadays, Islamic boarding schools are also starting to build or provide formal education, although they still follow the old education system such as *bandungan*, *sorogan*, and *wetonan*. Currently Islamic boarding schools have not utilized the Internet of Things (IoT) in running their organizations so they tend to remain conventional. Even though there are important things to disrupt IoT, such as optimizing facility management, where IoT enables efficient monitoring and management of facilities. For example, smart sensors can help monitor energy consumption, manage room temperature, and optimize resource use. Apart from that, Islamic boarding schools also improve educational experience services where IoT can improve the learning experience of students by providing access to more interactive and customized educational content. Smart devices can also be used to facilitate distance learning and collaboration between students. Apart from that, the use of an IoT-based administrative management system can increase efficiency in the administrative management of Islamic boarding schools, such as inventory management, finances and reports.

In addition, it is important to involve all relevant parties, including Islamic boarding school staff, students and local communities, in the process of implementing and developing this service. Implementing IoT in Islamic boarding schools can open up great innovative opportunities to improve the quality of life, security and overall management efficiency of Islamic boarding schools. However, along with these benefits, it is also necessary to pay attention to data security and privacy aspects to protect sensitive user information. The application of the Internet of Things (IoT) in Islamic boarding schools can create various innovative conditions that can improve efficiency, comfort and experience for students and Islamic boarding school managers.

As was previously noted, in order for education to really satisfy the demands of society, managers of educational institutions generally need to innovate in Islamic boarding schools as well. Particularly in Islamic boarding schools that combine traditional educational methods, the latest technological advancements have not been completely incorporated into Islamic boarding schools. For schools and students, the Internet of Things (IoT) can provide all-encompassing security solutions. Several Internet of Things (IoT) applications are used in Islamic boarding school education, including digital libraries, e-learning, video conferencing, and digital payments. The use of IoT technology shows how the Internet of Things has impacted Islamic residential schools. This systematic literature study seeks to analyze and categorize the literature on Internet of things in Islamic schools, especially for junior and middle school, given the significance of setting up and producing useful Internet of Things for Islamic schools. Analyzing and categorizing the literature on the Internet of Things in Islamic Boarding Schools is the goal of this project. Design and technique through the completion of literature reviews of works published in journals included in the Journal Citation Report between 2017 and 2023.

METHODS

The data utilized in this literature review are secondary data from reputable journals. The PRISMA approach is the one that is applied. The Preferred Reporting Items for Systematic Review and Meta-Analysis is referred to as PRISMA. Figure 1 displays the PRISMA diagram. The PRISMA flow method was utilized in the development

of a systematic literature review. Preferred Reporting Items for Systematic Review and Meta-Analysis is referred to as PRISMA. This PRISMA Flowchart is meant to help authors improve the way that reviews are reported in a methodical manner.

Figure 1 illustrates how, during the identification stage, 879 publications with an international reputation from various publishers were found by entering search keywords into the Google Scholar search engine. Following the discovery of 109 duplicate documents during the screening phase, the author chose the remaining 770 articles based on how well the abstract content related to the topic, ultimately choosing the remaining 540 abstract documents.

Using the same methodology as at the feasibility stage, the search is carried out to find full-text publications that will be used as study material for analysis. Twenty full-text papers were chosen at this point, and 20 of them talked about IoT in Islamic boarding schools. Fifteen papers were deemed suitable for examination up until the last stage as their subjects aligned with the goals of the study.

According to the Table 1, Indonesia conducts extensive study on the Internet of Things in Islamic Boarding Schools. Indonesia has a large number of Islamic boarding schools that could benefit from Internet of Things development. This scenario demonstrates that in a densely populated society, especially emerging countries, a growth in IoT is urgently required in Islamic schools, as well as favorable impact on the development of Islamic boarding schools by the government and business sector. Islamic boarding schools are a traditional Islamic educational institution that was revitalized by the Indonesian Muslim community. Islamic boarding schools are a completely marketable Indonesian cultural product, with the importance of serving as an educational instrument for indigenous people growing up in nature. Regardless of whether the traditional traditions in the system were adopted, it did not influence the unique patterns that have evolved and lived in the midst of social history (Azizah and Alli, 2020).

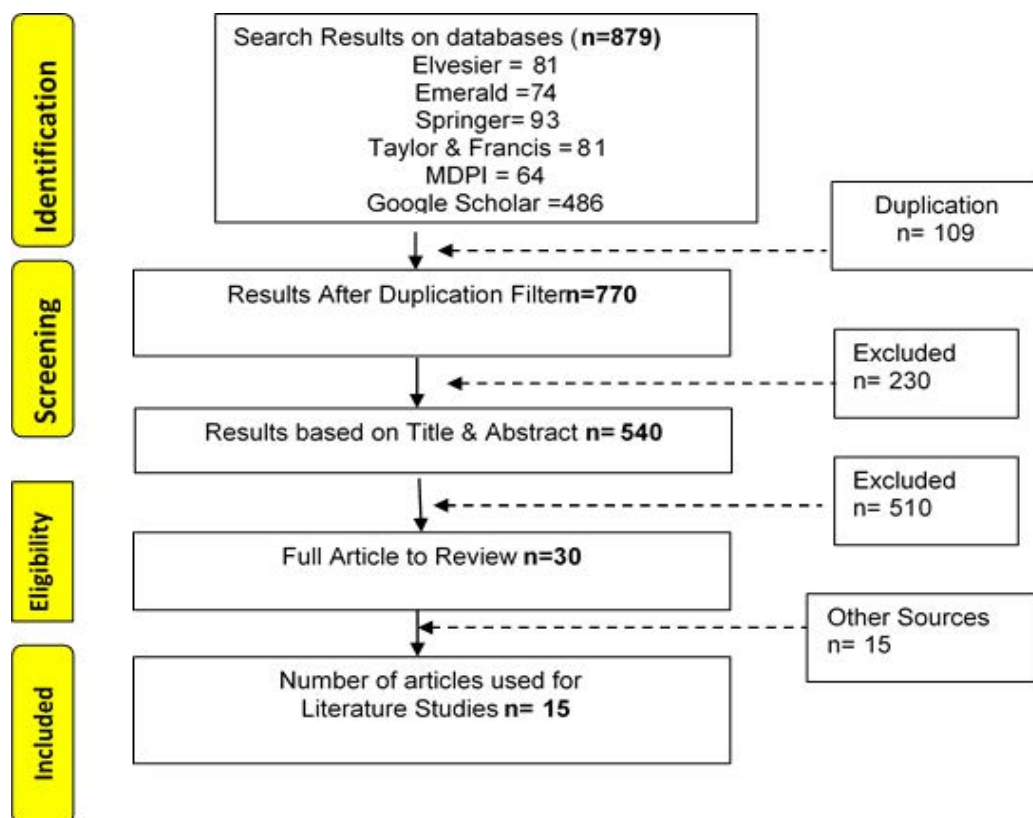


Figure 1. Diagram PRISMA internet of things on islamic boarding school

Table 1. The main topics in Internet of Things on Islamic Boarding School from 2017 to 2023

Author and Year	Type of Article	Description
Fahidatul et al. (2021)	Research Paper	Factors that influence professional organizations, namely: leadership, culture in organizational climate, a literary study of educational management in social sciences
Pramitha (2020)	Research Paper	From the results of the research, the results obtained were The organizational service process was carried out by motivating and inspiring the members of the boarding school, so that the organization had a high level of enthusiasm in developing Islamic boarding schools; The process of cultivating innovative behavior using logic by delegating tasks.
Kairiša and Lapiņal (2019)	Research Paper	The principles of quality culture are a significant factor in developing organizational competence, creating effective management processes in a resource-oriented approach that is implemented by focusing on the interests and objectives of the organization.
Inang et al. (2019)	Research Paper	Islamic boarding School for educational institutions has always been prepared to fill the workforce which is not yet the creator of job shortages.
Supriyanto and Zalendar (2020)	Research Paper	The organizational development in the development of local government employees has a positive influence on the work performance of regional employees
Lindqvist and Petterson (2019)	Research Paper	Findings show that school leaders view digitalization as a broad and complex concept technical, pedagogical, administrative and organizational challenges at all levels of school organization
Godin and Terekova (2021); Brunetti et al. (2017)	Research Paper	Transformation of educational institutions under the influence of ICT to analyze modern digital experiences transformation: a value chain model that describes the primary and secondary activities of a company educational institutions.
Daniar (2022)	Research Paper	The research results focus on three things, availability and suitability of human resources, business management have a culture and behavior that meets expectations, as well as the openness of the Islamic boarding school in establishing networking in the digital era
Yuwanda et al. (2023)	Research Paper	Several aspects that must be improved are 1. Digitalization of Human Resource Management Activities, 2. Creative Thinking, Innovative Behavior and Collaboration, 3. Digital Leadership and Transformation, 4. Digital Environment
Haris (2023)	Research Paper	Al-Amin Islamic Boarding School digitalizes by conducting digital literacy training for students through graphic design courses, providing laboratories as well as Islamic boarding school administration needs.
Zafi et al. (2021)	Research Paper	With the use of digital literacy, virtual Al-Qur'an, and innovative teaching methods, the Darul Ulum Kudus Islamic Boarding School is adjusting to the rapid advancements in technology. This makes it better for there to be Islamic boarding schools outside, which means that more and more people are aware of these programs.
Amali et al. (2022)	Research Paper	constructing an Internet of Things (IoT)-based solar energy system for the Islamic Boarding School at the Assyifa Islamic Boarding School Laboratory, Subang Regency, as a proactive measure to combat air pollution and provide a renewable energy source. managing air pollution and providing a remedy for the present energy shortage. Solar panels, an inverter, and an electric current controller with integrated WiFi connectivity are all part of the system's design.
Huda et al. (2020)	Research Paper	Numerous metrics, including financial performance, growing market share, efficient marketing, and innovation process
Obadia et al. (2017)	Research Paper	delivers information and the applicability of the IoT application, which is very strong for the success of learning, attitudes, and behaviour of students as the millennial generation in the Era of the Industrial Revolution 4.0. Aside from that, learning models such as Innovative Learning are the most appropriate models in the Industrial Revolution Era 4.0.
Syakroni (2019)	Research Paper	Among students at Nurul Jadid Islamic Boarding School from various levels of study, the results of the research demonstrated substantial changes in motivation and student learning outcomes after being exposed to learning with the IoT idea.

RESULTS

In Islamic School also start to implement IoT systems in their digital learning processes, then they are also implemented in security systems, for example in protecting the security of the digital data that we have in digital storage systems. According to data obtained from Forbes, the return of equipment connections using the mobile network system from 2015 to 2019 has always seen a return of 15.41 to 26.66 billion units. Then, most researchers also carry out forecasting up to the global scale, namely in 2025, IoT connectivity with alkaline devices will reach a fairly high point, namely 75.44 billion units (Columbus, 2017). In this writing, the aim is to understand the developments in IoT information systems in Islamic School. The Internet of Things (IoT) has become an integral part of the sustainability of today's organizations. Even as individuals, the advantages of the Internet of Things or IoT can be felt in many of the products we use every day. Examples of IoT-based products in everyday life are smart AC, smart TV, smart home system, smart LED and smart vacuum cleaner. As a form of technological discovery in general, IoT has advantages and disadvantages. This article will focus on these two aspects for companies.

The first advantage of the Internet of Things is that it provides efficient solutions without draining resources. It helps people with their work tasks so that working time becomes more efficient. Human resources in an organization can shift focus to other, more important work. Apart from that, the Internet of Things allows organizations to think about providing services and products that can support the increasingly dynamic and minimalist lifestyle of modern humans. We can see this in several business sectors, such as retail. The Internet of Things is useful for improving the inventory management process and delivering orders directly to buyers. Another example is in the electronics sector. Companies operating in this sector can use the Internet of Things to produce home electronic equipment that can respond to human commands using voice (Bahri and Ramaditya, 2024).

With the Internet of Things, Islamic boarding schools will continue to race to innovate in terms of research. This is the third advantage of the Internet of Things which aims to make organizations more competitive compared to competitors in the same field. This is because the Internet of Things is supported by artificial

intelligence which will continue to update data. Like it or not, organizations are required to continue studying the integration of the Internet of Things and artificial intelligence and the use of both in increasing efficiency within the organization. The Internet of Things has several weaknesses that every Islamic boarding school should be aware of. The first is that it is vulnerable to attacks in cyberspace. If the security system is not good, it is easy for cybercriminals to break into the company's Internet of Things system. A serious example occurred when 145,607 Dyn web cams were hacked in a DoS attack. We can divide this type of attack into three types according to the target of the attack. The first is a hack attack where hackers can only access Internet of Things software. Second, shack attack which means attacks on low-cost hardware.

Lastly, the lab attack is very dangerous because the hacker has attacked the laboratory equipment and then changed the contents of the Internet of Things device system freely. To create a hack-resistant security system, the company must carry out a risk assessment. At this stage, the company must know and then measure the potential risks that could occur with the device and the use of the Internet of Things. This risk assessment includes financial, physical and reputation risks. No less important is assessing risks related to network usage, the location where the Internet of Things is located and the user interface. The increasingly widespread use of the Internet of Things should make companies increasingly vigilant about how to keep these inventions safe from the risk of being hacked by criminals in cyberspace. From the explanation above, it can be concluded that an IoT-based organization is an organization that refers to the use of IoT to support the organization's daily activities in carrying out its activities with the aim of facilitating the organization's activities.

The evolution of the internet occurred due to the active role of the Internet of Thing (IoT) which has a direct relationship between users and digital processing which is combined with informality which is prohibited in everyday life (Kiryalkoval et al. 2017). IoT is simply a network of connected devices which is useful for supporting the communication process of device equipment. There are several technologies that use IoT such as: sensors, calculators, operational systems, microcontrollers, communications technology, securities, IoT platforms, and analytics (Genaldialrto et al. 2017). The working system of IoT technology already processes and transfers digital information

obtained from digital sensors such as Radio Frequency Identification (RFID), infrared sensors, and Global Positioning System (GPS). In addition to implementing IoT in business activities, residential physical systems have also been integrated with IoT, this technology is more often known as Smart Grid technology. Changes in Islamic Boarding School under the influence of IoT in Table 2.

Internet of Things (IoT) and digitalization are two concepts that are related but have different focuses. The following is a comparison between IoT and digitalization where the main focus of IoT is on connectivity and communication between physical devices. This involves collecting data from various sensors to provide better information and support data-based decisions. Digitalization. The focus of digitalization is broader, including the transformation of entire business processes into digital form. It involves the use of digital technology to change the way we work, interact and manage information. As we saw during the learning, IoT in Islamic boarding schools can become an embedded system that aims to expand the use of continuously connected internet connectivity. The importance of IoT modernization in Islamic education is because it eliminates skills gaps and lags (Syahansyah and Fatimatuzzahro, 2022).

Managerial Implication

The application of the Internet of Things (IoT) in Islamic boarding schools can create various innovative conditions that can improve efficiency, comfort and experience for students and Islamic boarding school managers. The following are some of the innovative phenomena that occur such as Monitoring the Health of Student. IoT. Use of IoT-based devices such as smartwatches or health sensors that can monitor students' health parameters, such as heart rate, body temperature and physical activity levels. This data can be accessed by Islamic boarding school managers and medical personnel for real-time health monitoring. Security and Environmental Monitoring with using Smart Security Systems: Implementation of smart security systems connected to an IoT network, including smart security cameras, motion sensors, and facial recognition systems to ensure Islamic boarding school security. Furthermore, environmental Monitoring: IoT sensors to monitor air quality, temperature and humidity around the Islamic boarding school. This can help identify potential health and safety issues. The limitation of the study can be used for future research that can used in different Area.

Table 2. Changes in Islamic Boarding School under the influence of IoT

Pedagogy			
Forms of Education	• Traditional Education	• Hybrid Education	• Technology Based Education
Types of interactions observed in the learning process	• Between student, between student and teachers, between student and materials, and between student and themselves.		
Technology			
Learning system	• Computer Based Technology, Web based Technology, Stand alone multimedia learning.		
		• Distance learning	• Elearning and Smart Education
Level of ICT Use	• Automation	• Informatization	• Digitalisasi
Transformation Objects	• Routine work of personnel units and trainees		
		• Strategy and Business Model	
Organisasi			
ICT Applications	• IT For Educational Organization Management Services		
Form of Organization	• Traditional Education Organization	• Advance in terms of IT organization and distance learning	• Online education organizations, Digital business organizations. Data Driven Company. etc.
Economy			
	• Collaboration-based economic model		
	• Financial Model of educational organizations		

CONCLUSIONS AND RECOMENDATIONS

Conclusions

According to the assessment of publications done, the Internet of Things (IoT) has the potential to cause major disruption in a variety of industries, including education and places such as Islamic boarding schools. Some of the challenges and relevance of IoT disruption for Islamic boarding schools include limited human resources, as well as financial and technological infrastructure. Implementing IoT technology necessitates an initial investment as well as ongoing upkeep, which can be costly. Furthermore, regarding security and privacy, IoT devices can increase data security and privacy risks. With so many connected devices, Islamic boarding schools need to ensure that their systems are safe from cyber attacks and protect students' personal data.

Recomendations

Currently Islamic boarding schools have not utilized the Internet of Things (IoT) in running their organizations so they tend to remain conventional. Even though there are important things to disrupt IoT, such as optimizing facility management, where IoT allows efficient monitoring and management of facilities. For example, smart sensors can help monitor energy consumption, manage room temperature, and optimize resource use. Apart from that, Islamic boarding schools also improve educational experience services where IoT can improve the learning experience of students by providing access to more interactive and customized educational content. Smart devices can also be used to facilitate distance learning and collaboration between students. Apart from that, the use of an IoT-based administrative management system can increase efficiency in the administrative management of Islamic boarding schools, such as inventory management, finances and reports. Thus, further research is an opportunity to examine the literature in the broader period and various digital search sources so that an overview of the development of research topic trends regarding internet of things in Islamic education as a guide for future research.

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