Application of Internet of Things (IoT) Devices for Better Awareness in Waziri Umaru Federal Polytechnic Birnin Kebbi

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Abstract: The Internet of Things (IoT) has emerged as a transformative technology, connecting physical devices to digital networks for seamless communication, monitoring, and analysis. This study explores the feasibility, benefits, and challenges of IoT adoption at Waziri Umaru Federal Polytechnic Birnin Kebbi, based on data collected from students, academic staff, non-academic staff, and management. A questionnaire-based research design was employed, with 114 respondents providing insights into IoT awareness, perception, and implementation barriers. Findings reveal that 76% of respondents are familiar with IoT, and 94.7% recognize its potential to enhance institutional efficiency, security, and resource management. However, financial constraints, lack of awareness, technical expertise, and security concerns pose significant challenges to IoT deployment. Despite these barriers, 60.5% of respondents expressed willingness to participate in IoT-related training programs, suggesting a strong foundation for future adoption. The study highlights the need for structured policies, investment in digital infrastructure, and targeted educational initiatives to facilitate IoT implementation in higher education institutions.

Keywords: Internet of Things (IoT), Institutional Adoption, Awareness, Perception, Feasibility, Challenges.

I. INTRODUCTION

The Internet of Things otherwise called the Internet of objects was coined by Kevin Ashton in 1999 for the first time. Which is a physical network connecting devices and things globally to internet infrastructure for sharing information with internal and external environments [1] and [2]. These IOT devices possess microprocessors and sensors for easier and simpler tracking and analysis [3]. The technology has architecture in the following dimension.

- Hardware: object enhanced with firmware/ embedded system and smart sensors
- Infrastructure: software that receives and analyzes, stores sensor data
- Apps: application for smartphones, tablets, Pc that connects hardware to the infrastructure and enable users to manage smart gadgets.

The more IoT devices in use in a particular environment the more activities are being monitored and the more results are potentially gained [3]. Consequently, decreases in costs and to-end messages and timely information will be achieved [4]. Finally, cohesive interaction and cooperation among students, staff, and school management will exist. This work intends to obtain valid opinions of students, and academic and non-academic staff of Waziri Umaru Federal Polytechnic Birnin Kebbi of benefit or otherwise of using IOT technology in the institution.

II. RELATED WORK

This section contains works done by some authors which has a direct relation and bearing with the Internet of Everything (IOE). Detailed IOT architecture such as hardware software and application in use was provided in [5]. In the submission, they also highlighted the Kenyan High educational system and what it takes to make IOT feasible in high educational institutions. Challenges of using IOT – privacy, security, cost and maintenance and recommendations were also mentioned.

In [3], IOT user's attitudes, material access, high education, and high income were scaled and measured. The research reported that IOT users with higher education backgrounds and those with high incomes possess positive attitudes toward IOT acceptability. They develop skills in usage and; use them for different purposes in different domains of life.

In another research conducted by [6], the historical background of IoT, its application, roadmap from inception, its future potentials, and potentiality in education were outlined. Herein also, mentioned some of IoT research development in the past which deals with its usage in education. For instance, smart education, smart teaching, smart learning, smart classroom, smart vehicle management, and the like. The benefits of IoT in education were discussed in their work.

A research anchored by [2], Blockchain and IoT were investigated to help educational development and progress. Areas where these technologies are beneficial such as securing school resources, reliable communication, and immutability. The authors recommend educational institutions to use them for fraud detection and to transmit financial transactions error-free. As for IoT, they reported that it guarantees student and staff quality of life.

A research work conducted by [1] proposed IoT systems that will serve as IoT learning labs for undergraduate engineering students. The students will use it to develop IoT applications and test it all on the system. The proposed system is composed of Hardware -- power supply Wi-Fi dongle, operator interface, circuit breaker, and so on. In the system, the four-channel Adriano relay, controller programming, communication protocol, mobile application, and cloud/web application were integrated and coupled. However, their remark stressed that it was the first kind of work where students train themselves on a system to design and develop IoT apps.

A work carried out by [4] discussed various technologies for collecting student data on campus. Manage it on the cloud and employ analysis with a via to maintain school infrastructure. The authors also propose an architecture for accomplishing the task. The architecture contains a centralized system capable of handling multiple tasks from classroom lectures to storing information in the database for further analysis and actions. Among the contributions were IoT benefits in education by stripping away obstacles of a financial nature, geology issues, and physical location issues among others.

In a similar work done by [7], IoT potentials in universities and benefits maximization were elaborated. The components of IoT, their impacts on education, challenges were also stated. However, they recommend the need to adapt to solve highlighted challenges by keeping track of essential resources, access to information, building IoT best

plans and policies, and designing of safer school environment for technological acceptability.

In the work of [8], the benefits of integrating IoT and big data in education were discussed. They, however, pointed out how important mining is for the discovery of new learning behaviors. On the other hand, challenges were listed ranging from security, IT policies, control, transparency, and fraud.

In another research conducted by [9], some areas or domains where IoE could be implemented were explained. Such areas include Car insurance -- where automobiles are connected to IoT network infrastructure for many updates. Also, the educational sector could take advantage of easy management, security, and access control of student and staff identity. On one hand, some challenges were itemized and discussed.

The work of [10] focuses on the main features of cloud platforms for smart cities coupled with IoT technology. In their work, Dubai City was used as a case study. The main contribution of the work is providing the possibilities and effectiveness of integrating IoT, and cloud computing into smart cities. And finally, the work itemized the financial benefits of the proposal.

III. METHODOLOGY

A questionnaire research design was used in this study. The target population of the study was 150, random sampling techniques were adopted and 114 questionnaires were distributed to the selected respondents, comprising students (87), academic staff (12), non-academic staff (12), and management (3). The questionnaire covered demographic information, IoT awareness, perception, feasibility, benefits, and challenges. Data was analyzed using frequency distributions and descriptive statistics.

IV. RESULTS AND DISCUSSION

➤ *Demographic Distribution*

Data were analyzed with the use of descriptive statistics using frequency count, and simple percentages. Table 1 below, shows the distribution of respondents by Age, and the result indicates that respondents between the ages of 20-30years (65%) are more aware of the Internet of Things (I.O.T) fellow by ages below 20 and 31-40 (16%) each, and the least age are 41- 50 with (3%) awareness in Waziri Umaru Federal Polytechnic Birnin Kebbi.

Table 1 Distribution of Respondents by Age

S/N	Age	Frequency	Percentage
1	Below-20	18	16%
2	20-30	75	65%
3	31-40	18	16%
4	41-50	3	3%
5	50-Above	0	0%

V. INTERNET OF THINGS (IOT) AWARENESS AND FAMILIARITY

In the concept of awareness and familiarity, the result indicates that about 76% of the respondents are familiar with the concept of IoT and only 24% reported being unfamiliar with this concept. Despite this awareness, about 52.6% had a basic understanding, while only 28.9% had an advanced grasp of IoT as shown in Fig 1 and 2 respectively.
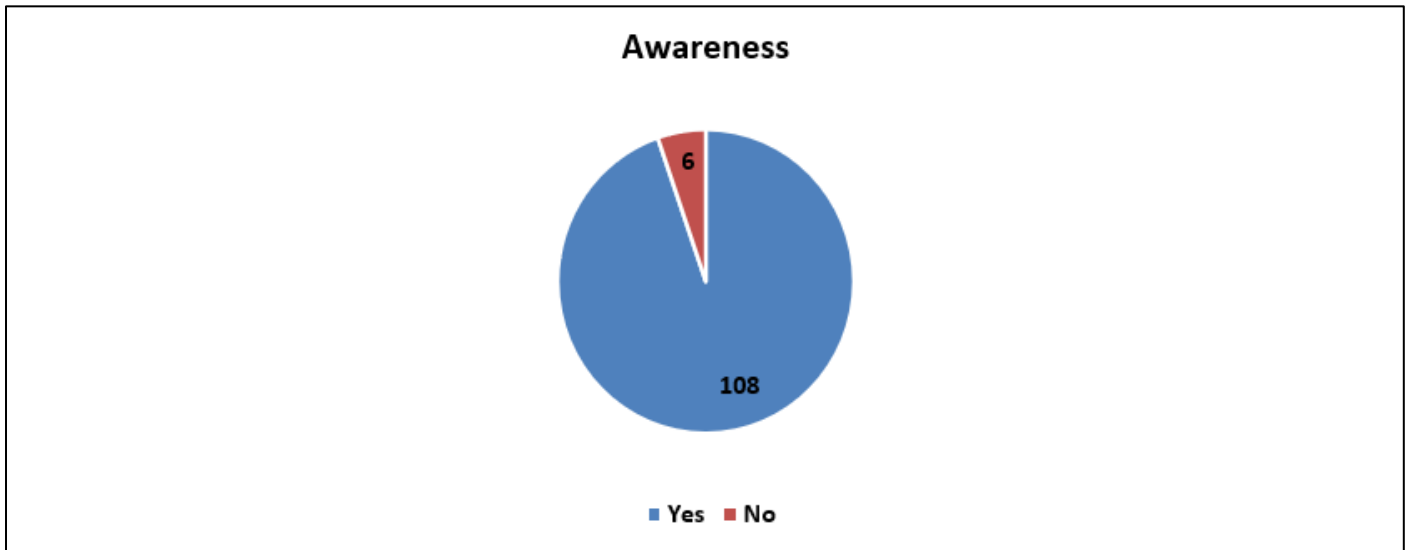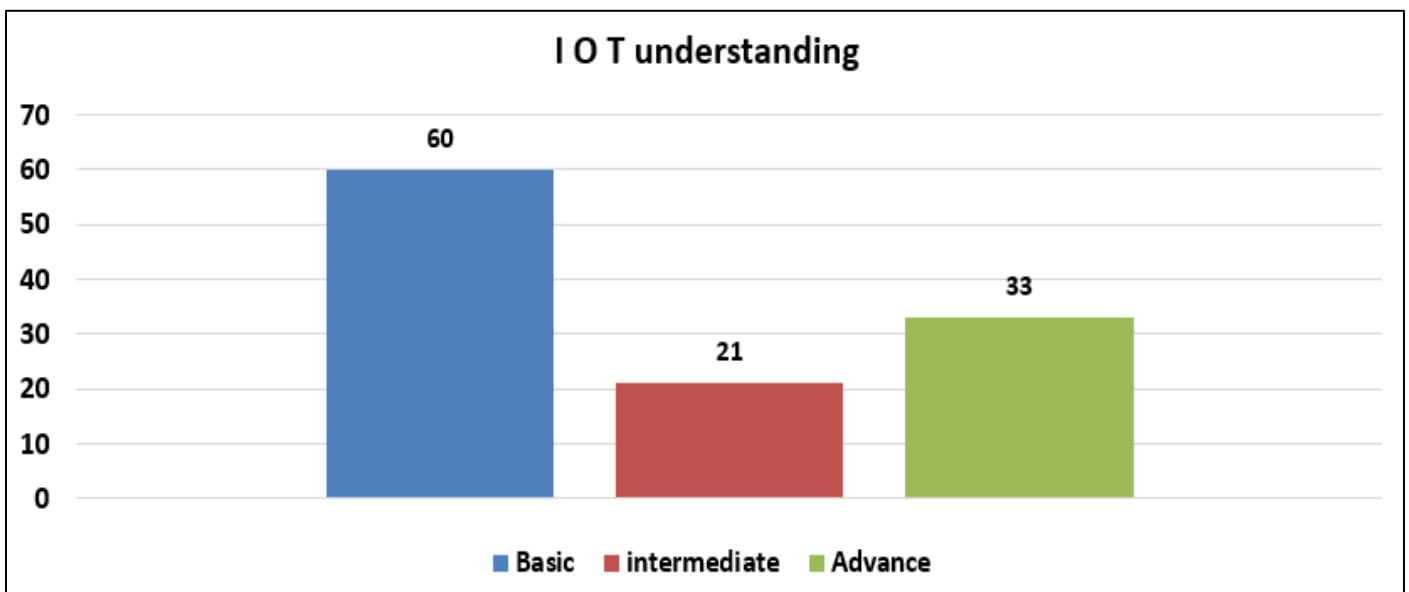

Fig 1 Level of Awareness

Fig 2 Level of understanding

This shows that IoT-enabled devices were been used in the institution despite varying levels of understanding, and these devices are been categorized as shown in Table 2 below.

Table 2 Category of Devices

S/N	Devices	Responses	Percentage
1	Smartphones	75	66%
2	Laptop	21	18%
3	Desktop computer	15	13%
4	Wearable device	3	3%

The responses from Table 2, indicate that a Smartphone is the most commonly used IoT device with 66% followed by Laptop with 18%, and the least device used is a wearable device with only 3%. This suggests that most respondents already use smart technology, making IoT adoption more feasible.

VI. PERCEPTION OF IOT BENEFITS

IoT adoption in educational institutions is widely perceived as beneficial, with the majority of respondents (94.7%) agreeing that it could enhance efficiency as shown in Fig 3. The most frequently mentioned advantages include enhanced security with (71%), improved communication with (13%), and optimized resource management (11%) as shown in Fig 4 below.
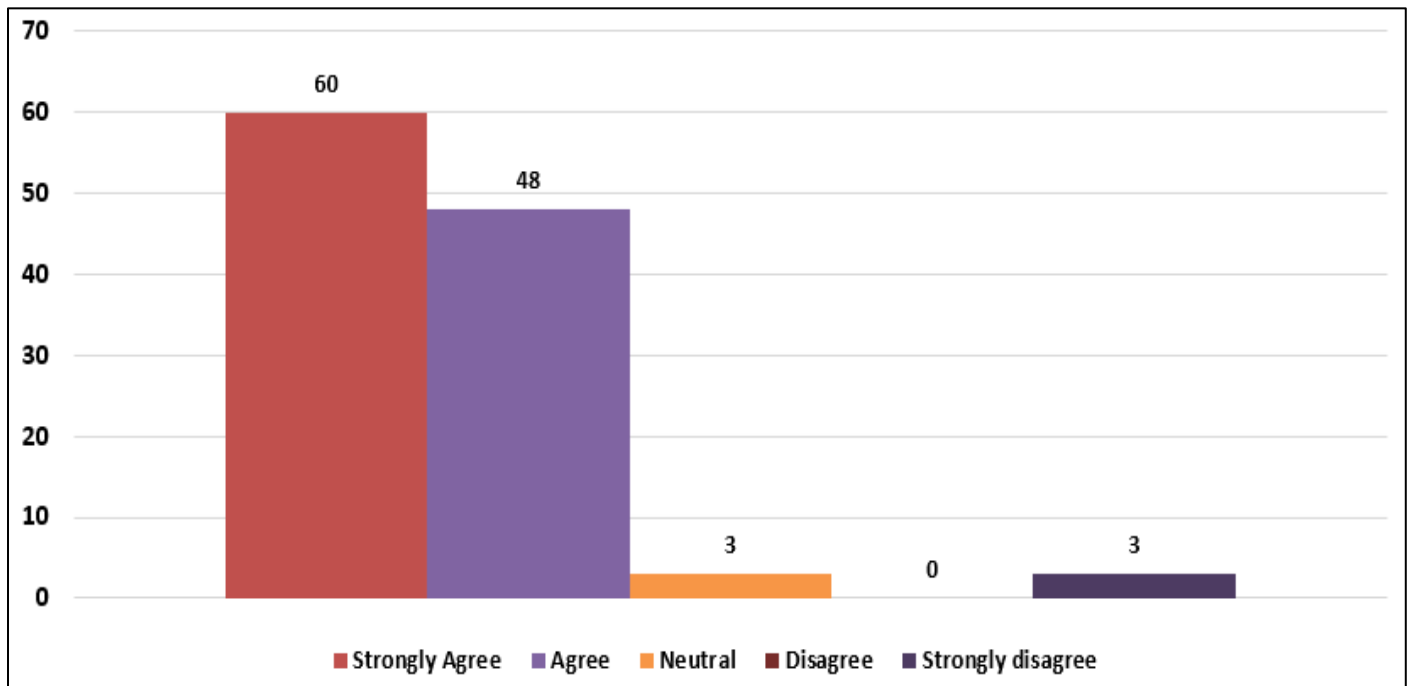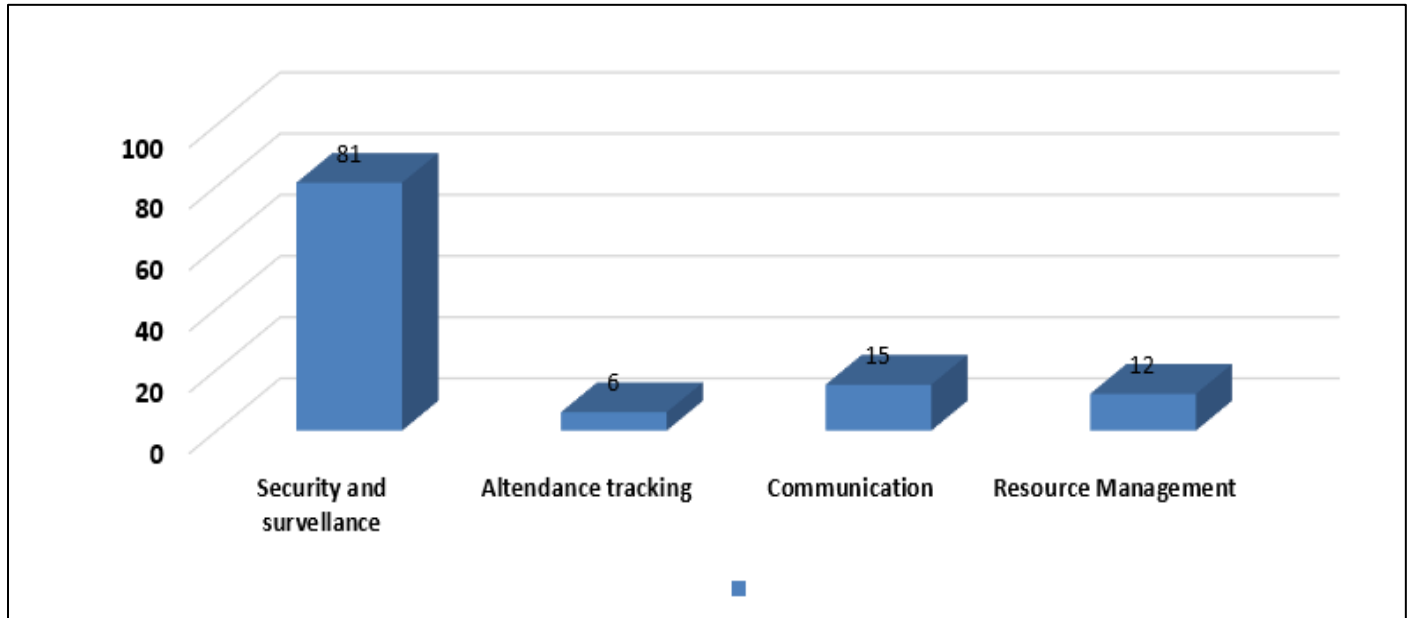

Fig 3 Perception of IoT on Efficiency

Fig 4 Advantage of IoT in Institution

This suggests a strong interest in IoT for security and operational efficiency in institutions.

VII. FEASIBILITY OF IOT DEPLOYMENT

The feasibility of IoT deployment in the institution is largely dependent on the availability of technological infrastructure, accessibility of IoT-compatible devices, and willingness to participate in IoT-related activities. In this study, 45% of respondents believed the current institutional infrastructure was sufficient for IoT implementation, while 16% disagreed, and 39% were uncertain as shown in Fig 5: below.
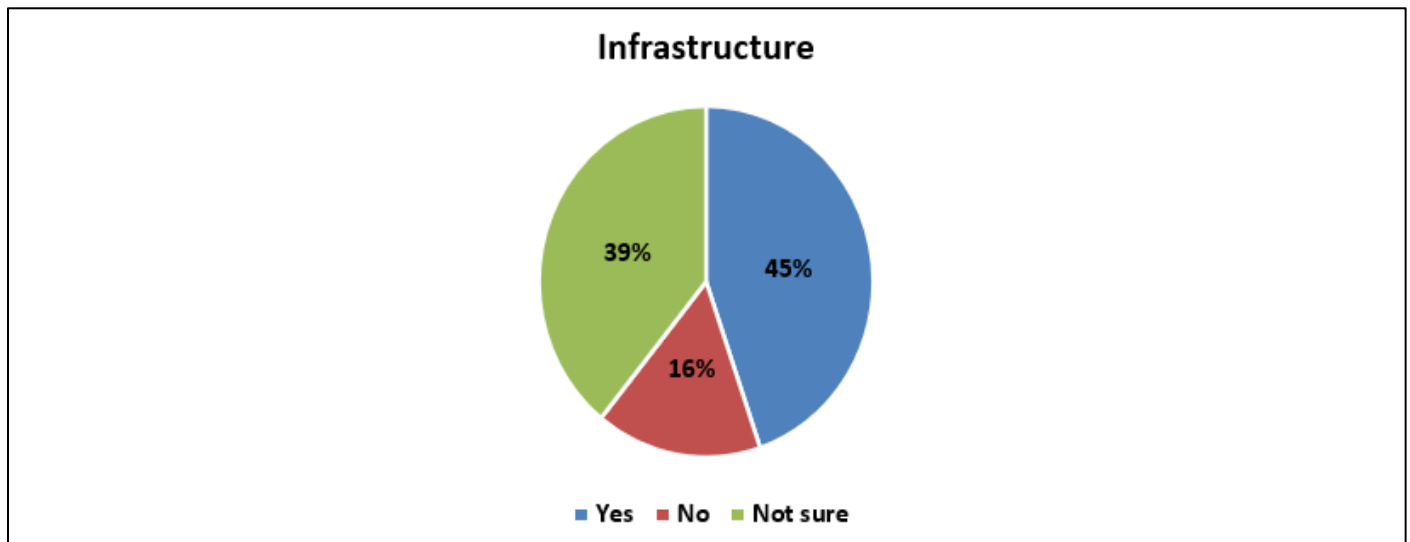
Fig 5 Technological Infrastructure

This indicates that while some individuals perceive the existing infrastructure as adequate, a significant portion remains skeptical about its readiness.

Additionally, 69% of respondents reported owning or having access to IoT-compatible devices, such as smartphones and smartwatches as shown in Table 2, which suggests a favorable environment for adoption. However, accessibility alone does not guarantee successful deployment; institutional support and training are also crucial. Encouragingly, 60.5% of respondents expressed willingness to participate in IoT-related workshops or training programs, highlighting a potential avenue for increasing awareness and technical expertise. Prior studies have emphasized that structured training programs and administrative backing play essential roles in driving IoT adoption in educational settings[11]. Therefore, investment in IoT-related infrastructure, coupled with targeted training initiatives, could significantly enhance the feasibility of IoT deployment in this institution.

VIII. CHALLENGES AND IMPLEMENTATION BARRIERS

Several challenges hinder the successful adoption of IoT in educational institutions. The most prevalent barriers identified in this study include financial constraints, lack of awareness, and technical expertise.

➢ *Financial Constraints:*
The high cost of installation was cited as a significant challenge by 44.7% of respondents. The acquisition and maintenance of IoT devices require substantial investment, which may not be feasible for institutions operating under tight budgets. Additionally, funding for infrastructural upgrades and security measures further exacerbates financial concerns.

➢ *Lack of Awareness:*
A considerable portion of respondents (42.1%) indicated that limited awareness about IoT remains a key barrier. Without adequate knowledge of IoT's benefits and applications, stakeholders may be reluctant to advocate for its implementation. This challenge underscores the need for awareness campaigns and educational initiatives to inform users about IoT technologies.

➢ *Technical Expertise:*
About 31.6% of respondents highlighted the lack of technical knowledge as a hindrance to IoT adoption. Effective implementation requires skilled personnel capable of managing IoT infrastructure, troubleshooting technical issues, and ensuring cybersecurity measures are in place. Institutions must invest in training programs to equip staff and students with the necessary technical skills.

➢ *Security and Privacy Concerns:*
Although not as widely cited as other barriers, security concerns remain an important consideration. The integration of IoT devices into institutional networks raises risks related to data breaches, unauthorized access, and cyber threats. Addressing these concerns requires robust security frameworks, regular audits, and strict access control measures.

IX. CONCLUSION

The integration of the Internet of Things (IoT) in educational institutions presents significant opportunities for enhancing operational efficiency, security, and resource management. This study, conducted at Waziri Umaru Federal Polytechnic Birnin Kebbi, assessed IoT awareness, perception, feasibility, and challenges among students, academic staff, non-academic staff, and management. The findings indicate that while a majority of respondents (76%) are aware of IoT, a significant portion lacks advanced technical knowledge. Despite this, the perceived benefits of IoT, including improved institutional communication, enhanced security, and optimized infrastructure management, were widely acknowledged. However, several barriers, such as financial constraints, lack of awareness, limited technical expertise, and security concerns, hinder the full-scale deployment of IoT within the institution. Addressing these challenges requires a strategic approach involving policy

development, investment in digital infrastructure, and capacity-building initiatives.

RECOMMENDATIONS

- Institutions should implement awareness campaigns and structured training programs to improve IoT literacy among students, staff, and management. Workshops, seminars, and hands-on training sessions can enhance knowledge and technical expertise, fostering greater acceptance and effective utilization of IoT technologies.
- Investment in IoT Infrastructure to ensure successful IoT adoption, the institution must prioritize the development of a robust digital infrastructure. This includes upgrading network systems, ensuring IoT device compatibility, and implementing cloud-based solutions for efficient data management.
- Financial Support and Funding Opportunities, the institution should explore funding options such as government grants, private-sector partnerships, and research collaborations. Allocating budgetary provisions for IoT development will facilitate sustainable implementation.

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