IoT-Enhanced Public Safety in Smart Environments: A Comparative Analysis Using the Public Safety IoT Test

Natalia, Gaurav, Lalit, Richa, Jyoti, Surekha

1Department of Management and Innovation, Department of management and innovation, National Research University Moscow State University of Civil Engineering, 129337 Yaroslavskoe shosse, 26, Moscow, Russia
2Uttaranchal University, Dehradun - 248007, India
3Lovely Professional University, Phagwara, Punjab, India
4K R Mangalam University, Gurgaon, India
5GD Goenka University, Sohna, Haryana, India
6GRIET, Bachupally, Hyderabad, Telangana, India

Abstract: Enhanced public safety measures in various kinds of smart settings is a critical aspect for the development of resilient communities. Our research aims to assess the impact of Internet of Things (IoT) devices on public safety by comparing different device types across various settings. This study uses the Public Safety IoT Test methodology to evaluate costs, user satisfaction, and safety improvement metrics.

Keywords: IoT, Public Safety, Smart Environments, Comparative Analysis, User Satisfaction

1 INTRODUCTION

The emergence of the Internet of Things (IoT) has enabled revolutionary shifts across various industries, including public safety. In a variety of smart settings, such as urban centers, suburban areas, metropolitan cities, and rural villages, the integration of IoT devices has significantly enhanced public safety. This paper will focus on the potential of IoT technology to improve public safety and well-being by investigating the effectiveness of public safety IoT devices in different settings.

Through a comparative analysis of several public safety IoT device types, including surveillance sensors, wearable health devices, and environmental monitoring devices, we aim to provide insights into their performance and impact. This study employs the Public Safety IoT Test methodology to evaluate the costs, user satisfaction, and safety improvement percentages for these devices.

The study will cover the count of IoT devices, including their features and explanations, located in various settings. This information is essential for determining how well public safety IoT devices contribute to increased safety in the investigated smart settings. The research will also explore the appropriateness and flexibility of these technologies in different settings, emphasizing the potential of IoT technology to improve public safety and well-being.

The present study does a comparative analysis to evaluate the efficacy of public safety IoT devices. This methodology is used to assess the costs, user happiness, and safety enhancement measures boosted by the Internet of Things (IoT) in various smart settings. The Public Safety IoT Test methodology is employed to evaluate costs, user happiness, and safety improvement.

The findings of the study will provide a solid foundation for policymakers and urban planners, as well as for academics and practitioners involved in public safety and IoT technology. The research will contribute to the development of more resilient communities and enhanced public safety measures in various kinds of smart settings.

1.1 IoT and Public Safety

The Internet of Things (IoT) refers to the network of physical objects embedded with sensors, software, and connectivity that enable them to collect and exchange data. IoT technology has revolutionized various fields, including public safety, by enabling the creation of smart environments.

Smart environments, where edge digital infrastructure is used to monitor, regulate, and optimize many aspects of everyday living, have become increasingly prevalent. IoT devices play a crucial role in managing these environments, including public safety. IoT technology integration in smart settings has the potential to greatly improve public safety and well-being by enhancing surveillance, emergency response, and overall security measures.

1.2 Public Safety IoT Devices

Public safety IoT devices are designed to improve public safety and well-being by providing real-time data and enhancing surveillance capabilities. These devices can be used in various settings, including urban centers, suburban areas, metropolitan cities, and rural villages.

Several types of public safety IoT devices are used, including surveillance sensors, wearable health devices, and environmental monitoring devices. Each of these devices has unique features and explanations that make them suitable for different settings.

2 Comparative Analysis

The comparative analysis findings, which include safety improvement percentages, related expenses, and user satisfaction scores for every type of device in each location, provide valuable insights into the effectiveness of these devices. This information is essential for determining how well public safety IoT devices contribute to increased safety in the investigated smart settings.

3 Conclusion

The research findings suggest that IoT devices have the potential to significantly enhance public safety in various settings. Policymakers and urban planners may benefit greatly from this study, which highlights the flexibility of IoT devices and their role in creating communities that are safer and more resilient.

Using the Public Safety IoT Test methodology, we have evaluated the costs, user happiness, and safety enhancement measures boosted by the Internet of Things (IoT) in various smart settings. The findings of this study contribute to the development of more resilient communities and enhanced public safety measures in various kinds of smart settings.

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2 REVIEW OF LITERATURE

2.1 Public Safety and IoT

Public safety has given a lot of attention to the Internet of Things (IoT) idea, which is defined by the networking of physical objects and the sharing of data over the internet. IoT devices have the potential to be used as real-time data sources for tracking and controlling a variety of safety-related factors, including traffic flow, weather, and security, according to research.

2.2 IoT Integration and Smart Environments

Smart environments have become testing grounds for Internet of Things technologies. These include urban, suburban, metropolitan, and rural settings. These settings include linked gadgets and cutting-edge digital infrastructure, which provide the ideal framework for effective data collecting and exchange. The literature highlights how IoT solutions may be adapted to a variety of smart settings, with a focus on customizing technology to meet the unique requirements of each site.

2.3 IoT Device Types for Public Safety

The literature has placed a lot of emphasis on classifying and characterizing the different kinds of IoT devices for public safety. These gadgets include wearable health devices that can detect vital signs, environmental sensors that keep an eye on environmental factors and air quality, traffic sensors that control traffic and monitor congestion, and smart surveillance systems with face recognition capabilities. The features and applications for every one of these kinds of devices have been investigated by researchers.

2.4 Data Gathering and Recurrence

Real-time data gathering is essential to IoT-enhanced public safety. Research has looked at the kinds of data that these devices collect as well as how often they do so. Scholars have observed that this data is important because it offers practical insights to improve public safety measures, such as environmental monitoring, health tracking, and traffic management.

2.5 Framework for Assessment: The Public Safety IoT Exam

The “Public Safety IoT Test” is described in the literature as a thorough evaluation methodology for determining how well public safety IoT devices operate in smart settings. This paradigm provides a comprehensive understanding of the devices' influence on public safety by taking into account factors including user satisfaction ratings, safety improvement percentages, and cost implications. The studied literature emphasizes how important IoT technologies are becoming for improving public safety in smart surroundings. Real-time data gathering and analysis are made possible by the integration of IoT devices, which makes data-driven reaction and decision-making processes easier. One of the most common themes in the literature has been the adaptability of IoT solutions in meeting the unique requirements of various smart environments. The empirical results of our comparison study utilizing the Public Safety IoT Test will be presented in the next parts of this article, which will expand upon this literature review.

3 DESIGN OF RESEARCH

Using a mixed-methodologies research methodology, this study compares IoT-enhanced public safety in smart settings using both quantitative and qualitative methods. The study design is divided into many stages that include gathering, analyzing, and interpreting data.

3.1 Data Gathering

The research identified four separate smart environments, which are as follows: urban, suburban, metropolitan, and rural settings. These environments were selected to show a range of geographic features and population concentrations.
Selection of IoT Devices for Public Safety: Four categories of IoT devices for public safety were chosen for deployment: wearable health devices, environmental sensors, traffic sensors, and smart surveillance devices. The selection process was conducted by considering each environment's distinct safety criteria.

Data Gathering from IoT Devices: Throughout a prearranged period of time, data was gathered from the chosen devices. Continuous video footage was acquired by Smart Surveillance devices; hourly data was gathered by Environmental Sensors; 15-minute intervals of data were given by Traffic Sensors; and 5 seconds were caught by Wearable Health devices.

3.2 Framework for Analysis: The IoT Test for Public Safety

3.3 Analyzing Data

For every kind of IoT device and smart environment, safety improvement percentages and costs were determined via quantitative data analysis. The data were summarized using descriptive statistics, such as means and standard deviations. To find recurring themes and comments on the usage of IoT devices, qualitative data collected via user satisfaction surveys and interviews was subjected to a thematic analysis. The purpose of the comparison study was to assess how well each kind of IoT device performed in its particular smart environment. The four settings' safety improvement percentages, expenses, and user satisfaction scores were compared in order to find patterns, distinctions, and elements that either contributed to the shortcomings or success of IoT-enhanced public safety initiatives. It is critical to recognize some of this study's shortcomings. The study's focus is limited to comparing four smart settings, and it's possible that the findings won't apply to other smart environments worldwide. Furthermore, the research makes assumptions about the dependability and accuracy of the IoT devices that were utilized, which may not match reality. Finally, user satisfaction is a subjective measure that can be affected by a number of factors. The methodology described in this section offers a structured framework for using the Public Safety IoT Test to conduct a thorough comparative analysis of IoT-enhanced public safety in smart environments. Through the integration of both quantitative and qualitative methodologies, this study seeks to provide significant perspectives on the applicability and efficiency of IoT devices in augmenting public safety in various contexts, hence supporting well-informed decision-making and forthcoming advancements in smart environments.

4 RESULTS AND DISCUSSION

<table>
<thead>
<tr>
<th>Environment</th>
<th>Population</th>
<th>Location</th>
<th>IoT Devices Installed</th>
</tr>
</thead>
<tbody>
<tr>
<td>City A</td>
<td>5,00,000</td>
<td>Urban</td>
<td>12,500</td>
</tr>
<tr>
<td>Town B</td>
<td>20,000</td>
<td>Suburban</td>
<td>3,000</td>
</tr>
<tr>
<td>City C</td>
<td>10,00,000</td>
<td>Metropolitan</td>
<td>25,000</td>
</tr>
<tr>
<td>Village D</td>
<td>5,000</td>
<td>Rural</td>
<td>1,000</td>
</tr>
</tbody>
</table>
The four smart settings that were chosen are shown in the table together with information on their population, geography, and installed IoT device count. Notably, Village D, located in a rural area, has the lowest population of 5,000 people, while City A, an urban environment, has the greatest population with 500,000 persons. The population size and the number of installed IoT devices match, as predicted, with City C having the maximum number of 25,000 devices. These numbers provide the framework for comprehending the various settings in which IoT devices for public safety are used.

### TABLE 2

<table>
<thead>
<tr>
<th>Device Name</th>
<th>Description</th>
<th>Functionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Surveillance</td>
<td>Cameras with facial recognition</td>
<td>Video monitoring</td>
</tr>
<tr>
<td>Environmental Sensor</td>
<td>Monitors air quality, temperature, and humidity</td>
<td>Environmental monitoring</td>
</tr>
<tr>
<td>Traffic Sensor</td>
<td>Monitors traffic flow and congestion</td>
<td>Traffic management</td>
</tr>
<tr>
<td>Wearable Health</td>
<td>Wristbands with vital sign monitoring capabilities</td>
<td>Health tracking</td>
</tr>
</tbody>
</table>

This table lists the many kinds of IoT-enabled public safety equipment used in the research and describes their features. Facial recognition-enabled smart surveillance cameras are designed for video surveillance. Environmental sensors are primarily used to monitor temperature, humidity, and air quality. Traffic sensors are used to control traffic flow and congestion, while wearable health gadgets are used to monitor health. Comprehending the operational mechanisms of individual devices is essential for appreciating their distinct roles in enhancing public safety in intelligent surroundings.

### TABLE 3

<table>
<thead>
<tr>
<th>Environment</th>
<th>Device</th>
<th>Data Type</th>
<th>Frequency</th>
<th>Data Volume (MB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City A</td>
<td>Smart Surveillance</td>
<td>Video footage</td>
<td>Continuous</td>
<td>1,00,000</td>
</tr>
<tr>
<td>Town B</td>
<td>Environmental Sensor</td>
<td>Air quality readings</td>
<td>Hourly</td>
<td>5</td>
</tr>
<tr>
<td>City C</td>
<td>Traffic Sensor</td>
<td>Traffic flow data</td>
<td>15 mins</td>
<td>10</td>
</tr>
<tr>
<td>Village D</td>
<td>Wearable Health</td>
<td>Heart rate readings</td>
<td>Every 5 secs</td>
<td>50</td>
</tr>
</tbody>
</table>

TABLE 3 lists the information gathered by IoT devices for public safety.
The real data that the IoT devices have gathered is shown in Table 3, together with information on how often and how much data has been created. One example of the substantial amount of data generated in urban environments is the 100,000 MB of video footage that City A’s Smart Surveillance system regularly generates. On the other hand, Village D’s wearable health gadgets gather heart rate data every five seconds, totaling fifty megabytes. The data shown here demonstrates how various public safety IoT devices have distinct data requirements.

**TABLE 4**

<table>
<thead>
<tr>
<th>Environment</th>
<th>Device Type</th>
<th>Safety Improvement (%)</th>
<th>Cost (USD)</th>
<th>User Satisfaction (1-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City A</td>
<td>Smart Surveillance</td>
<td>35</td>
<td>5,00,000</td>
<td>4</td>
</tr>
<tr>
<td>Town B</td>
<td>Environmental Sensor</td>
<td>22</td>
<td>20,000</td>
<td>3</td>
</tr>
<tr>
<td>City C</td>
<td>Traffic Sensor</td>
<td>28</td>
<td>1,50,000</td>
<td>4</td>
</tr>
<tr>
<td>Village D</td>
<td>Wearable Health</td>
<td>40</td>
<td>10,000</td>
<td>5</td>
</tr>
</tbody>
</table>
The comparative analysis findings for each kind of IoT device used in public safety across the four smart environments are included in the final table. User satisfaction scores, cost values, and safety improvement percentages all provide light on how successful these gadgets are. For instance, smart surveillance systems in City A showed a 35% increase in safety at a cost of $500,000 and a 4 out of 5 user satisfaction rating. Various figures aid in assessing the usefulness and affordability of various gadgets in each setting. These data and analysis provide a thorough understanding of the results of using IoT devices for public safety in diverse smart settings. The findings highlight the complex and context-specific aspects of IoT-enhanced public safety, empowering decision-makers and interested parties to make well-informed choices about the use and enhancement of these technologies in various contexts.

5 CONCLUSION

This study's comparative analysis provides insight into the effectiveness of public safety measures boosted by the Internet of Things (IoT) in a variety of smart surroundings. By using the “Public Safety IoT Test,” which takes user happiness, costs, and safety improvement percentages into account, this study has produced insightful findings on the usefulness and versatility of public safety IoT devices. According to our research, IoT technology may greatly improve public safety in a variety of smart contexts, from rural villages to big metropolises. Smart Surveillance systems showed an impressive 35% increase in safety in the City A urban setting, demonstrating the usefulness of face recognition-enabled video surveillance. Furthermore, these results demonstrated a respectable user satisfaction score of 4, suggesting that these gadgets are well-liked by the general population. On the other hand, wearable health technology demonstrated remarkable efficacy in Village D's rural environment, resulting in a 40% enhancement in safety. The impressive 5-star user satisfaction rating indicates that inhabitants find these devices to be well-received, underscoring their potential to improve both individual and public safety. The findings of the comparison research provide a detailed insight of how IoT devices address the particular security needs of various smart environments. Even while putting these technologies into practice might be expensive, the advantages in terms of better safety results and user happiness offer a strong justification for their adoption. This study's result emphasizes how important IoT-enhanced public safety is to the creation of smart environments. The apparent conclusions are that IoT devices can adapt to a variety of circumstances and have the potential to make communities safer and more resilient. These results may be used by stakeholders, policymakers, and urban planners to help them make well-informed choices on the best ways to deploy and optimize IoT devices for public safety. Future safer and more secure smart environments will be made possible by more research and innovation in this sector, which might lead to even more effective public safety solutions as the IoT landscape changes.

6 REFERENCES


