Monitoring Internet of Things (IoT) in Medan City MSMEs

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ABSTRACT

The growth of Internet of Things (IoT) technology has a significant impact on the Micro, Small, and Medium Enterprises (MSMEs) sector. This study aims to analyze and implement an IoT-based monitoring system in MSMEs in Medan City. This research involves surveys, interviews, and prototype development as the main methodologies. First, a survey was conducted to understand the level of readiness and awareness of MSMEs towards IoT technology. The findings of this survey became the foundation for designing solutions that fit the needs of the MSME sector. In-depth interviews with MSME owners provided deep insight into the challenges and opportunities faced in adopting this technology. Furthermore, based on the survey findings and interviews, a prototype IoT monitoring system was developed and implemented in several MSMEs in Medan City. The system includes connected sensors, communication modules, and a simple yet effective user interface. Evaluation results from the prototype implementation show that MSMEs in Medan City can gain significant benefits from IoT technology, including improved operational efficiency and inventory monitoring. In this context, the successful implementation illustrates the potential positive impact of IoT technology on the productivity and competitiveness of MSMEs. This research provides a comprehensive view of the challenges and opportunities of IoT implementation in the MSME sector, providing a foundation for the development of strategies and policies that support the adoption of this technology. The implications of the findings can contribute to the development of a technology-enabled MSME ecosystem in Medan City and provide insights that can be applied to similar contexts across the region.

Keywords: *Internet of Things (IoT)*

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1. INTRODUCTION

Micro, Small and Medium Enterprises (MSMEs) play a crucial role in the economy, especially in a fast-growing city like Medan. In the digital era, technological advancements, especially the Internet of Things (IoT), have opened up new opportunities and significantly impacted the way MSMEs conduct their business operations. However, in the context of MSMEs in Medan City, there are a number of challenges that need to be overcome to optimize the utilization of IoT technology[1]. MSME owners often face limited resources, limited knowledge of the potential of IoT, as well as the availability of adequate infrastructure. As a result, many MSMEs have yet to fully utilize the potential of this technology to improve their business efficiency and competitiveness[2]. In facing the era of digital transformation, the sustainability of MSMEs as the backbone of the local economy is crucial[3]. Therefore, the need for an in-depth understanding of how IoT[4]. technology can be implemented and utilized effectively by MSMEs in Medan City is very important[5].

2. RESEARCH METHODOLOGY

This study uses a mixed-methods research design that combines quantitative and qualitative approaches. This approach enables comprehensive data collection and in-depth understanding of the implementation of Monitoring for Internet of Things (IoT) in MSMEs in Medan City[6]. The population of this study is MSMEs in Medan City. The sample is purposively selected by considering variations in industry sector, business size, and

level of technology adoption. A number of MSMEs representing these characteristics will be invited to participate in this study[7]. An online survey will be used to collect quantitative data related to MSMEs' adoption level, awareness, and perception of IoT technology. Survey questions will be developed based on related literature and the results of preliminary interviews with MSME owners. In-depth interviews will be conducted with selected MSME owners to gain an in-depth understanding of their challenges, benefits, and experiences in adopting IoT technologies[8]. This qualitative data will provide a deeper context related to IoT implementation in MSMEs. Prototype Development Based on the findings from the survey and interviews, a prototype of an IoT-based monitoring system will be developed. This prototype will include sensors relevant to the needs of MSMEs, communication modules, and an intuitive user interface[9]. Implementation and Data Collection Implementation The prototype will be implemented in several MSMEs that are willing to participate in the pilot test. Implementation data involves monitoring system performance, user response, and the effectiveness of collecting the required information. Quantitative data will be analyzed using descriptive statistical methods and inferential analysis. Qualitative data from interviews and observations will be analyzed using a thematic approach to identify patterns and key findings[10].

3. RESEARCH RESULTS

A quantitative survey was conducted to evaluate the level of Internet of Things (IoT) readiness and adoption among Micro, Small, and Medium Enterprises (MSMEs) in Medan City. Based on survey data from 100 MSME respondents, the following picture is obtained:

MSME Readiness Level towards IoT:

80% of the respondents stated that they have basic knowledge about IoT.

Only 45% feel ready to adopt IoT technology in their business.

Main Barriers to IoT Adoption:

60% identified implementation cost as a major barrier.

30% felt that lack of knowledge and technical support was an obstacle.

Qualitative Interview Results

In-depth interviews were conducted with 15 MSME owners representing various industry sectors. The key findings from the interviews were:

Limited Resources:

Most MSMEs feel limited in terms of financial and human resources to adopt and manage IoT technologies.

Limited Awareness:

A number of respondents admitted that they have not fully realized the potential and benefits of IoT technology to improve operational efficiency.

Prototype Implementation and Testing

The IoT-based monitoring system prototype was implemented in six MSMEs that agreed to participate. Testing involved inventory monitoring, performance monitoring, and user response to the system interface. The test results showed:

Operational Efficiency:

There was a significant improvement in inventory monitoring, reducing the time required for stock management.

User Response:

80% of MSME owners stated that the system's user interface is easy to understand and use.

Discussion

Resource Limitations:

Despite constraints related to limited resources, prototype testing showed that operational efficiency can be improved by utilizing IoT technology.

Financial Barriers:

Financial barriers can be overcome by developing an affordable cost model or seeking alternative funding sources, such as government subsidy programs or cross-sector cooperation.

Role of Awareness:

There is a need to increase awareness and education campaigns to raise the awareness of MSMEs about the benefits of IoT technology. Involvement of government and educational institutions can help in this regard.

User Interface:

Positive responses to the user interface indicate the importance of designing a system that is user-friendly and easy to adopt by MSME owners without specialized technical expertise.

4. CONCLUSION

Based on the results and discussion, it is recommended to develop training programs, encourage cross-sector cooperation for funding, and continuously improve the user interface so that IoT technology can be more

widely adopted by MSMEs in Medan City. These steps are expected to improve the competitiveness of MSMEs and support local economic growth.

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