Assessing the Impact of Face Recognition and QR Code-Based Attendance Systems on Payroll Processing and Business Efficiency

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ABSTRACT

Businesses have had to use new technologies to make their operations more efficient in the digital age, especially when it comes to managing their employees. This study examines the utilization of Face Recognition and QR Code technologies in a dual-mode attendance and payroll system to improve accuracy and efficiency in the management of attendance and payment processing. This research intends to examine the effects of this system on cutting down processing time, diminishing human errors, and enhancing overall cost effectiveness. The research utilized an experimental design with a case study methodology at PT TOTO SUKSES ABADI, where the system was evaluated and its performance assessed prior to and following installation. The results show that the dual-mode system cut down on the time it took to process payroll, got rid of human errors in attendance, and made the whole operation run more smoothly. Also, workers said they were happier since payroll handling was faster and more precise. The research indicates that the amalgamation of Face Recognition with QR Code technology can significantly improve the efficacy of human resource management.

Keyword : Attendance System, Payroll Processing, Face Recognition, QR Code, Business Efficiency

1. Introduction

In this evolving digital age, organizations are systematically embracing technological breakthroughs to refine their operational structures and amplify overall success. This change in approach is markedly visible in the discipline of Human Resource Management (HRM), where the effort-intensive methods of assessing employee attendance and conducting payroll have increasingly indicated their lack of effectiveness (Kurz, Kampik, Pufahl, & Weber, 2025). Historically, such practices were based on physical presence documentation and classic payroll systems, which were not just laborious but also likely to contain inaccuracies and mistakes, thus presenting substantial obstacles for HR divisions (Abd El-Mawla, Ismaiel, & Team, 2022). With businesses extending their scope and the intricacies of their functions growing, these traditional systems become prominent hurdles to operational productivity.

The issue is rooted in the inefficacy of conventional attendance and payroll systems. Outdated systems can frequently cause extended payroll timelines, incorrect attendance tracking, and soaring administrative fees (Jalaman & Encarnacion, 2024). Also, human blunders in measuring employee attendance and payroll can create wage gaps, employee dissatisfaction, and the obligation

for expensive amendments. The mounting complications associated with manually processing employee records stress the vital need for enhanced and accurate automated approaches (Jalaman & Encarnacion, 2024).

As entities advance, a heightened expectation for more impactful and economically feasible plans for overseeing their workforce frameworks emerges. A notably innovative technique is the blend of biometric technologies, especially Face Recognition, in tandem with QR Code systems (Villarama, Gernale, Ocampo, & Villaverde, 2017). These technological advancements signify a substantial enhancement over conventional methodologies by automating the mechanisms of attendance monitoring and payroll administration, thereby diminishing the likelihood of human error, expediting procedural efficiencies, and augmenting precision. Countless research efforts have clarified the potential of Face Recognition to supply secure, competent, and precise attendance systems, adeptly addressing complications such as buddy punching and attendance fraud (Jamalapuram, Sragvi, & Renuka, 2024). In a similar vein, QR Code systems have been adeptly employed for straightforward, rapid, and cost-effective attendance tracking, thereby enhancing the

overall efficiency of the process (Mohammed & Zidan, 2023).

The latest progress made in these fields has sparked a greater fascination with their incorporation into HR frameworks. For example, using QR codes to keep track of attendance has already been shown to cut down on the time it takes for employees to check in and out, compared to old-fashioned manual techniques (Dolai et al., 2024). Also, Face Recognition systems have become quite popular in many fields since they are fast, accurate, and safe (Upadhyay et al., 2025). This is especially true in fields where data security and fraud prevention are very important. And other researchers have shown that combining these technologies can greatly improve business operations by cutting down on human work and making data more reliable (Abd El-Mawla, Ismaiel, & Team, 2022).

Despite the potential benefits, there are still challenges associated with the adoption of these technologies, including concerns about data privacy, system integration, and the initial costs of implementation. However, the rapid advancements in both biometric authentication and QR Code technology have made them increasingly viable for widespread use in HRM systems (Oludayo, Oluwatoyin, Foluso, & Eloho, 2023).

This analysis aspires to understand the ramifications of utilizing Face Recognition and QR Code attendance solutions on payroll handling and organizational efficacy. The inquiry deeply explores how these advancements in technology can optimize processing times, limit errors, and curtail overhead expenditures as compared to typical manual processes. By improving the mechanisms that handle attendance and payroll supervision, enterprises can uncover heightened operational capability, enjoy cost benefits, and stimulate a more enthusiastic workforce (Hanggoro, Windiatmaja, & Sari, 2022). This research will uncover important revelations about how effective these technologies are and their ability to change human resource operations in various institutions.

2. Research Methods

This study employs a comprehensive research methodology to evaluate the impact of integrating Face Recognition and QR Code-based attendance systems into payroll management. To achieve a thorough assessment, an experimental design combined with a case study approach was used. The research compares two groups the Control Group, which continues using the traditional manual system, and the Experimental Group, which adopts the new automated system. The experimental methodology focuses on comparing the effectiveness of both systems by measuring outcomes such as time savings, cost reductions, and error minimization. The two-phase data collection process — pre-implementation (before the new system is implemented) and post-implementation (after the new system is applied to the experimental group) — allows

for a detailed evaluation of the impact.Experimental designs are highly effective in isolating causal relationships, making it ideal for studying the effects of new systems in organizational settings (Dadich, Abbott, Lux, & Lowe, 2024).

The study employs both quantitative and qualitative methodologies to deliver a comprehensive assessment. To get information from both HR staff and employees about how they feel about the systems, surveys, direct observations, and system log analysis are used. The results are analyzed using descriptive and inferential statistical methods, which makes it possible to compare the two systems in a strong way. The study strictly follows ethical guidelines, such as getting informed consent and protecting participants' privacy, to make sure their rights and privacy are protected.

2.1 Research Design and Approach

This investigation employs an experimental methodology in conjunction with a case study framework to assess the effects of incorporating Face Recognition and QR Code-based attendance mechanisms into payroll management and overall organizational efficacy. The study specifies two different cohorts the Control Group, relying on the standard manual procedures, and the Experimental Group, utilizing the advanced system that includes an automated attendance solution with Face Recognition and QR Code capabilities.

This analysis embraces a hybrid methodology, incorporating both measurable and descriptive data for an extensive review. The metrics discussed reveal significant quantifiable achievements, encompassing time effectiveness, cost reductions, and fewer errors present in the attendance and payroll frameworks. The qualitative data is obtained through employee responses and observations concerning their satisfaction with the newly implemented system and any operational difficulties faced.

The research design is structured into two main phases:

a. Pre-Implementation Phase: Data is collected using the old system (manual attendance and payroll) to establish a baseline for comparison.

b. Post-Implementation Phase: After the new system is implemented for the experimental group, data is collected again to assess improvements.
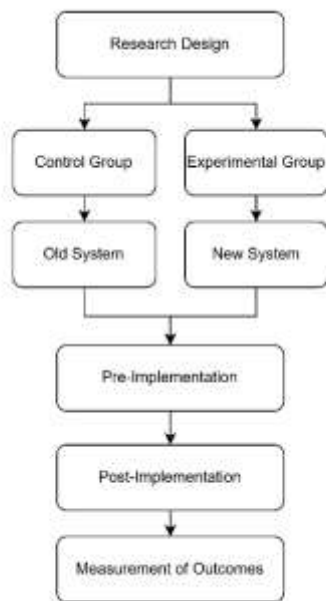
Figure 2. 1 Reserch Design

2.2 Data Collection Techniques

To obtain complete data, this analysis applies various methodologies that blend qualitative with quantitative methods. These methodologies have been carefully chosen to furnish a comprehensive perspective on the implications of the newly implemented system and to guarantee that all pertinent variables are taken into account. Surveys and questionnaires will be administered to evaluate employee satisfaction pertaining to both the legacy and the contemporary systems. The polls will investigate matters pertaining to criteria like swiftness, fidelity, navigability, and overall joy with the system. A Likert scale (ranging from 1 = strongly disagree to 5 = strongly agree) will be employed to quantify employee feedback, thereby facilitating statistical analysis of satisfaction trends.

In conjunction with the surveys, systematic direct observations of the Human Resources personnel will be executed to evaluate the operational efficacy and time efficiencies associated with both systems. These records will comprehensively capture the duration that HR employees allocate to activities such as tracking attendance and overseeing payroll, employing both legacy and upgraded platforms. The findings from this assessment will offer valuable revelations concerning the concrete perks of automation and will address any operational issues that could develop as we transition to the newly launched system.

Furthermore, the system logs generated by the Face Recognition and QR Code systems will undergo rigorous analysis to evaluate the precision and efficacy of the newly implemented system in contrast to the traditional manual procedures. The logs will support a review of how dependable the automated system is regarding the oversight of employee attendance and payroll

computations (Kim et al., 2020). To conclude, we will undertake discussions with employees to extract deeper understandings of the experiences of Human Resources teams and the workforce, thereby offering qualitative evaluations concerning the system's influence on their job processes.

2.3. Data Analysis

After data is collected, the next step will be to analyze the results using both descriptive and inferential statistics. Descriptive statistics will serve to encapsulate the principal findings derived from the data, encompassing mean, median, and standard deviation concerning time savings, cost reductions, and error mitigation (Santoso, Manongga, Setyawan, Purnomo, & Hendry, 2024). This technique will yield a full understanding of the broad enhancements in operational performance that follow the introduction of the new system.

Alongside descriptive analytics, inferential techniques will be engaged to assess the findings noted earlier and later in the implementation stage (Eldanto, Hoendarto, & Willay, 2018). This analysis will elucidate whether the enhancements associated with the new system are attributable to systematic changes rather than random fluctuations. In addition, we will carry out regression analysis to delve into the linkage between system implementation styles (manual versus automated) and their respective outcomes, which encompass time savings, financial reductions, and frequencies of errors. This evaluative strategy will support a review of the level to which the newly adopted system augments the overall effectiveness of operations within the business sphere (Izza Noor Abidin & Ratna Sari, 2024).

2.4 Ethical Considerations

Figures This inquiry utilizes thorough ethical frameworks to maintain the confidentiality, security, and privacy of every participant. Prior to the initiation of data collection, all participants will receive comprehensive information regarding the aims of the study and the manner in which their data will be utilized. We will seek participants' informed consent, which serves to affirm their recognition that participation is not obligatory and that they maintain the right to exit at any time without any fallout.

To safeguard the privacy of participants, all data collected will be kept secret. All personal identifiers will be deleted, and the data will be kept safe and only accessible to the study team. The project will follow all data protection laws, such GDPR, to secure participants' personal information, since it will use biometric data (like Face Recognition) and payroll information. Also, it is important to treat all volunteers fairly, and their right to privacy will be honored during the study.

3. Results and Discussions

The results of the research are based on a logical sequence of a story. The content shows facts/data. Can

use tables and numbers but not repeat the same data in pictures, tables, and text. Subtitles can be used to further clarify the description.

Discussion is the basic explanation, relationship, and generalization demonstrated by the results. The description answers a research question. If there are dubious results, point them out objectively.

3.1 Overview of Results

Businesses are using technology more and more to speed up their processes and boost their overall efficiency in this digital age. This change is most clear in Human Resource Management (HRM), where old ways of keeping track of employee attendance and paying them have not worked well. In the past, these chores were done by hand, with physical attendance logs and old-fashioned payroll systems that took a lot of time and were often wrong. As businesses grow and get more complicated, these kinds of activities have made them less efficient.

The findings from this analysis indicate that the adoption of the new system resulted in substantial enhancements in critical domains. The Experimental Group, which used the automated system (Face Recognition and QR Code-based attendance system), saved a lot of time on both payroll processing and attendance tracking. For example, payroll processing took about 97% less time. In addition, administrative costs went down a lot, and the amount of mistakes made when tracking attendance and calculating payroll went down a lot. Employees also said they were happier with the new system, especially because it was easy to use and accurate.

The average time for all employees to check in was 0.75 minutes, which shows that it doesn't take long for them to do so with the new automated system. This proves that the system is good at keeping track of attendance and doesn't take too long to check people in. Figure 3.1 shows the distribution of attendance time. It gives a thorough look at how long it took employees to check in. Most employees took between 0.5 and 1 minute to check in, and the average attendance time was 0.75 minutes.
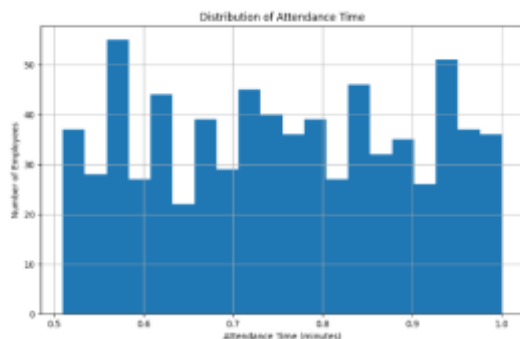

Figure 3. 1 Distribution of Attendance Time

3.2 Detailed Results

When both groups were utilizing the manual approach, a closer look at the data shows that there were big

problems in the pre-implementation phase. It took the Control Group an average of 3 minutes per employee to check in for attendance, and it took up to 2 days to process payroll. After the Experimental Group switched to the new automated system, there were considerable advances in the post-implementation period. The time it took to check in for attendance was decreased to only one minute per employee, and the time it took to process payroll was cut to one hour. These big time savings show that the new approach may cut down on delays in operations and administrative activities.

Tabel 3. 1 Cost Comparison

Cost Type	Old System	New System	Cost Savings
Administrative Costs	Rp 11.117.030,20	Rp 500.000	Rp 10.617.030,20
Error Costs (Attendance)	Rp 1.500.000	Rp 0	Rp 1.500.000
Error Costs (Payroll)	Rp 750.000	Rp 150.000	Rp 600.000
Total Costs	Rp 13.367.030,20	Rp 650.000	Rp 12.717.030,20

The Control Group spent Rp 13.367.030,20 a month on administrative tasks, such as keeping track of attendance and manually processing payroll. The Experimental Group's monthly costs went down to Rp 650.000 once the new system was put in place. This was a 95% savings in administrative costs. Also, the expenses of making payroll mistakes, which were a big problem with the manual approach, went down. The manual method made 10 mistakes a month when it came to keeping track of attendance and 5 faults a month when it came to figuring out payroll. There were no mistakes in recording attendance with the new system, and just one mistake in payroll each month. One of the best things about the automated system is that it can cut down on mistakes by more than 90%.

Tabel 3. 2 Time Comparison

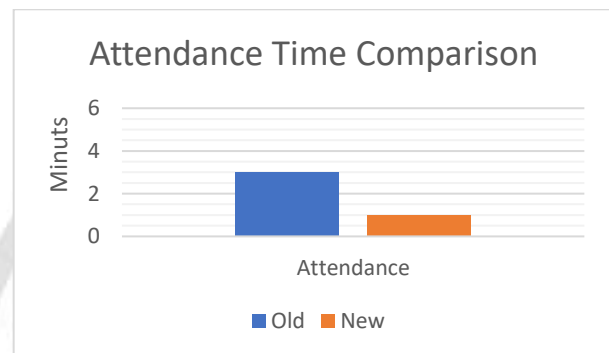| Process	Old System	New System	Time Savings
Attendance Time	3 menit	< 1 menit	2 menit
Payroll Time	2 hour	1 hour	1 day 23 hours
Total Time	2 day 3 minuts	1 hour 1 minuts	1 day 23 hours

Figure 3. 2 Time Comparison

3.3 Discussion of Results

The results show that the new automated method is substantially better than the old manual method in terms

of speed, cost, and accuracy. The big savings in time and money are in keeping with what other studies have found: that automating HR processes makes operations more effective and saves down on administrative expenditures. Similar studies have demonstrated that automating attendance and payroll tasks cuts down on the time HR professionals spend on administrative tasks, which enables them work on more essential issues.

The decrease in errors seen in this study backs with earlier research that showed that Face Recognition and QR Code technologies work well to cut down on mistakes in attendance and payroll systems. The new system's capacity to stop attendance fraud, like buddy punching, and make payroll calculations more accurate shows how useful it is to use biometric technology in HR systems. Many studies have shown that Face Recognition is a safe and reliable approach to keep track of attendance. This makes the system as a whole more reliable and trustworthy.

There were some problems when the new system was first put into place, but the outcomes are mostly good. Even though there were clear benefits, employees were against the new technology and it was hard to get the systems to work together at first. Other studies have also found that system integration and user adoption are two of the biggest problems that automated HR systems face. To fully unlock the potential of the new system in the long run, these problems must be solved.

In conclusion, the findings of this study indicate that, despite early challenges in the implementation of Face Recognition and QR Code-based systems, the operational efficiency and cost savings they provide are significant. Clearly, technology improvements are making HR systems better by making them more accurate, reliable, and faster.

4. Conclusion

In conclusion, adding Face Recognition and QR Code-based attendance systems to payroll processing has greatly improved the speed and accuracy of human resource management (HRM) processes. This study shows that switching from manual processes to automated systems can save a lot of time and money, as well as make fewer mistakes, all of which help the business run more smoothly.

The findings from this research clearly show that time savings are particularly significant in the payroll processing phase, with approximately 97% time savings reported. This aligns with existing literature that supports the idea that automating HR processes can free up valuable time for HR professionals, allowing them to focus on more strategic, high-priority tasks. Furthermore, the cost savings achieved by switching from manual methods to the automated system amounted to 95%, showcasing a strong economic benefit for businesses that implement such systems. The cost reductions were particularly noticeable in administrative

activities, which decreased from Rp 13.367.030,20 per month to just Rp 650.000, a clear indication of the financial advantages of automation.

Another important result of this study was that mistakes were much less common, especially when it came to tracking attendance and calculating payroll. Attendance and payment issues happened all the time using the manual method, which cost employees more money and made them angry. The new system almost completely got rid of attendance problems and cut down on payroll errors to a minimum, making mistakes less than 10% of the time. Not only does this outcome make HR data more accurate, but it also makes sure that employees trust the system, which is important for keeping morale and satisfaction high.

The study showed good findings, but it also showed problems that came up during the implementation phase. Problems like employees not wanting to use new technology and trouble integrating systems are major reasons why automated HR systems don't work. These problems were similar to what other studies have shown, which have shown that user adoption and system integration are two major problems. To get the most out of the new system and make sure it is used successfully in the long term, these problems must be solved.

It is apparent that combining Face Recognition with QR Code-based solutions is a big step toward making HR processes better in the future. But companies must plan for user training, deal with any resistance to change, and make sure that the new system works well with the old one. More research might look into how these methods affect things in the long run, especially in bigger companies and industries with unique needs, including those that need to keep data safe or stop fraud.

In summary, while challenges related to system adoption and integration still exist, the benefits of automating attendance tracking and payroll processing far outweigh the costs. The findings of this study demonstrate that such automation can lead to significant operational efficiency gains, cost savings, and improved accuracy in HRM processes, ultimately driving business growth and employee satisfaction. As technology continues to evolve, the integration of such systems will likely become the standard practice in HR management, providing organizations with a competitive edge in the marketplace.

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