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Development of A QR Code-Based Attendance System for Factory Employees

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Abstract: Employees are the most asset for any company. Achieving the best results from employees should be accompanied by a comfortable working environment. Whether working in an office or in the field, attendance is of utmost importance. Attendance is a crucial factor that can support and motivate every work activity. In this advanced era, many companies still rely on manual attendance systems. The use of manual systems often leads to errors caused by both administrators and employees, such as inefficient paper usage, failure to report absences, delayed submission of monthly reports, or loss of paper records. These issues can lead to employee carelessness, as there is a risk of attendance manipulation with manual (paper-based) attendance systems, resulting in attendance data falsification. By implementing QR codes, employees only need to scan the code using their smartphones. This research employs Unified Modeling Language (UML) for modeling. The application is then developed using Kodular and Firebase. The purpose of this application is to simplify attendance reporting for business owners or company managers, eliminating the need for manual attendance data recording, and making the attendance system of the company or factory more efficient.

Keywords: Employees; Attendance; QR Code; UML; Kodular.

1. Introduction

Technology has become increasingly pervasive and expansive in today's era, permeating various domains, including the realm of work. This has led business owners to adopt a more advanced mindset, ensuring they stay up-to-date, especially in the field of information technology. Notably, the workforce also benefits from technological advancements, and this can be particularly seen in the domain of employee attendance management [1]. Employee attendance, which encompasses punctuality and discipline, is a pivotal aspect of workplace management and productivity assessment. Currently, many organizations still rely on manual methods for tracking employee attendance, such as signature-based attendance sheets submitted before the end of the workday. However, this method has several drawbacks, including the potential for employee fraud. Furthermore, the use of fingerprint-based attendance systems can be cumbersome and expensive due to the high costs associated with the hardware. Additionally, implementing such a system requires the collection of fingerprint data from all employees, which can be quite intricate in this technologically advanced era.

According to Roy Harianto (2020), the proliferation of smartphones has reached new heights, and experts have developed sophisticated tools that operate solely using smartphones [2]. Smartphones are not only ubiquitous but also considered practical and efficient for managing attendance in the digital age. A QR code-based system, which allows employees to scan QR codes using their smartphones, offers numerous advantages. Data is instantly recorded in a computer database in real-time, eliminating the need for manual data entry and reducing processing time. Previous research has also explored similar technological solutions for attendance management. For instance, Fitri Ayu and Ari Mustofa (2019) designed a web-based employee attendance system that simplifies the record-keeping process and provides managers with an easy way to monitor employee attendance [3]. Tambunan and S. Zetli (2020) developed an Android-based QR code employee attendance application, which aids employers in monitoring their workforce [6]. Several studies have also integrated other technologies, such as RFID (Radio Frequency Identification) or fingerprint recognition, to enhance attendance accuracy. Nevertheless, the use of QR codes has proven to be a more cost-effective

and practical method for implementing employee attendance systems. The objective of this research is to develop an efficient and practical QR code-based employee attendance system that will enable organizations to manage employee attendance effectively, mitigate the risk of fraud, and streamline attendance reporting. This research will utilize the Unified Modeling Language (UML) for system design and employ tools such as Kodular and Firebase for application development. As such, this research aims to contribute to the enhancement of efficiency and professionalism in employee attendance management.

2. Research Method

2.1 Research Framework

The research framework represents the initial blueprint devised by the author to facilitate the development of a structured research design. In this phase, the author formulates a scheme from inception to completion, ensuring that the research's organization and presentation follow a logical sequence.

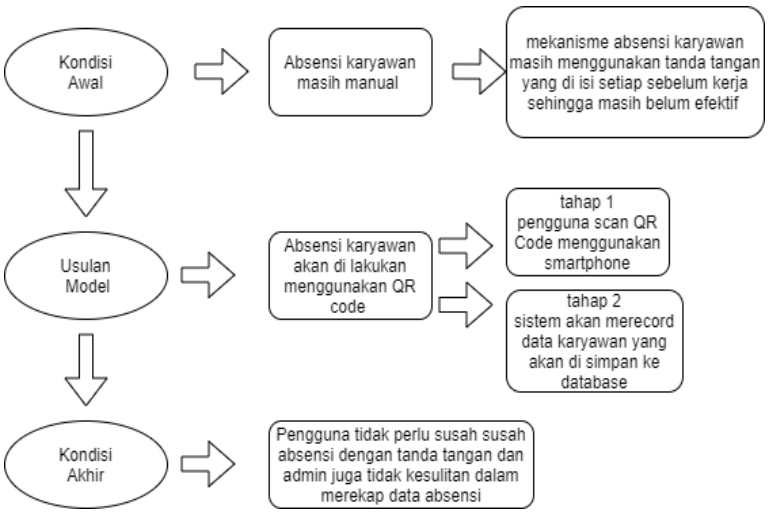

Figure 1. Research Framework

2.2 Data Collection

Data for this research is procured directly by the author from the factory or referenced from scholarly journals. Data acquisition methods encompass observation and interviews. The author conducts firsthand observations, interviews company owners, and analyzes the system's requisites. Data collection serves the purpose of obtaining information pertinent to the issues essential for system design. In this study, information is gathered progressively, including the following:

1) Interviews
   Interviews are conducted to elicit specific information directly from factory owners.
2) Observation
   This research entails direct investigation by the author into the subject matter under study, with the objective of comprehending the functioning of the system in the field.
3) System Requirements Analysis
   The author strives to amass information and ascertain facts to ensure comprehensive and accurate data gathering, enabling the system to recognize the input information provided by system users.

Data collection for this research took place from October 15, 2023, to November 1, 2023.

2.3 Model Architecture

The model architecture encapsulates the conceptualization of the QR code-based employee attendance system in this study.

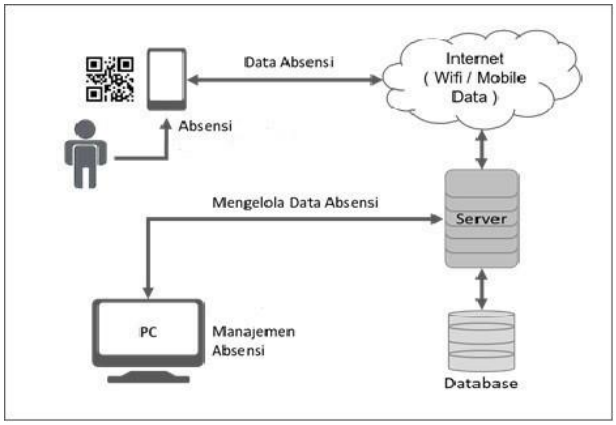

Figure 2. Model Architecture

The QR Code-based Employee Attendance Application is crafted in alignment with the established concept, and its operations adhere to the diagram depicted in Figure 2 above. In Figure 2, users transmit attendance data to the database, which is subsequently stored on the server, and the server PC administers the database.

3. Result and Discussion

3.1 Results

This research proposes the Development of an Employee Attendance System for Factories using QR Code to simplify attendance tracking and data compilation. Functional requirements can be categorized into three aspects: input requirements, necessary processes, and expected outputs. In terms of input requirements, the system must possess the ability to record employee attendance effectively while also being open to receiving input from administrators. Moving on to process requirements, the system should be equipped to store attendance records securely within a server database and should have the capacity to display the necessary data in response to specific commands. In the context of output requirements, the system's success is measured by its ability to function in accordance with its original objectives. Additionally, emphasis is placed on the user interface and application design, emphasizing user-friendliness and visual appeal to enhance the overall user experience.

3.2. Discussion

The employee attendance system application comprises six screens: the login screen, admin login screen, employee login screen, admin home screen, employee data summary screen, and admin data summary screen.

(a) Homepage

(b) Admin login page

(c) Employee login page

(d) Admin home page

(e) Employee home page

(f) Data recap page

Figure 3. App View

In Figure 3.a, the initial page presents two buttons: one for employee login and the other for admin login. Users can choose to log in as either an admin or an employee. Figure 3.b displays the admin login screen, which includes two input fields for username and password, as well as two buttons for canceling and logging in. Clicking the login button directs the admin to the home screen, while clicking the cancel button returns to the initial screen. Similarly, Figure 3.c shows the employee login screen, which mirrors the admin login with two input fields for username and password, along with cancel and login buttons. Figure 3.d illustrates the admin home screen, featuring three buttons: logout, which returns to the initial screen, rekap (summary), which displays the data summary screen, and generate, which creates a QR Code based on the entered information. Figure 3.e depicts the employee home page, which includes a drop-down menu to select attendance type (check-in/check-out), a scan button to initiate attendance scanning, and a logout button. Figure 3.f presents the data summary, sourced from the database, displaying employee names, attendance type (check-in/check-out), dates, and check-in times. A back button at the bottom-right returns to the admin home screen.

3.3. Testing

In the testing phase, the author assessed the application's functionality and tested it on various devices, as detailed in the table below.

Table 1. Application Functionality Testing

Page	Hope	Observation	Information
Admin login	Enter email and password	Incoming data	Succeed
Employee login	Enter email and password	Incoming data	Succeed
Home admin	Create QR Codes	QR appears	Succeed
Home employee	Scan QQ Code	QR is scanned and data is entered	Succeed
Recap admin data	Reading data in the database	Data appears	Succeed

Table 2. Application Functionality Testing on Various Smartphones

Smartphone	Specification	Information
Oppo Reno 5	8gb RAM, Android 11, Snapdragon 720G	Smooth operation
Oppo Reno 5f	8gb ram, Android 11, Mediatek helio P95	Smooth operation
Realme 5	4 GB RAM, Android 9, Snapdragon 665	Smooth operation

Tables 1 and 2 above confirm that the application functions smoothly and can run on devices with varying specifications, from low to high-end devices.

4. Related Work

A multitude of academic studies have focused on the development and implementation of attendance management systems in various sectors, including both employee and student attendance. These studies highlight the evolution and diverse applications of these systems. Fitri Ayu and Ari Mustofa (2020) developed a web-based employee attendance

system to enhance the efficiency of attendance recording at CV. Cahaya Toner [18]. Rully Roosdianto, Ani Oktarini Sari, and Arief Satriansyah (2021) made a significant contribution with an automated attendance system for central office employees at the Kantor Satpol Pp Dan Wh Aceh, using unique identifiers for tracking [5]. Nilam Cahya (2020), introduced a fingerprint-based system for managing student attendance, integrated with Visual Basic 6.0 and using Arduino for fingerprint recognition [5]. H. P. Tambunan and S. Zetli in the same year developed an Android-based employee attendance application using Android Studio and MySQL [6]. Reva Ragam Santika, Yudi Wiharto, and Ari Irawan in 2021 proposed an RFID-based employee attendance system, which used RFID cards and readers for data generation [7]. Yiyi Supendi, Irwin Supriadi, and Agustinus A. W. Isto (2019) utilized QR codes in a mobile-based system for student attendance management [8]. Danindya Puput Muliana Putri and Heru Supriyono, in their 2019 research, focused on a QR code-based system for laboratory assistants using the Codeigniter framework [9]. Afif Priyambodo, Koredianto Usman, and Ledya Novamizanti in 2020 transformed student data into QR codes for attendance management [10]. Nandang Hermanto, Nurfaizah, and Nur Rahmat Dwi Riyanto (2019) explored a mobile-based QR code system for student attendance [11]. Didi Juardi (2019) developed a QR code-based system with SMS notifications for parental involvement [12]. Qubaila Ega Fazrin (2021) employed Extreme Programming to develop a QR code-based employee attendance application [13]. Y I Kurniawan, A L Nurjaman, and L Afuan that year introduced a comprehensive software system for employee attendance using QR codes [14]. Fitri Nuraeni, Ridwan Setiawan, and Ridzky Ichlasul Amal (2022) designed an online student attendance system using QR codes for in-person sessions during COVID-19 [15]. Amal Julio Rafila and others in 2020 implemented a QR code system for student attendance at STMIK "AMIKBANDUNG" [16]. Finally, Sri Murni and Raja Sabaruddin (2018) transitioned from manual to web-based student attendance tracking using QR codes, aiming to improve data management and security [17]. These studies collectively advance the field of attendance management systems, offering context-specific solutions.

5. Conclusion

In summary, the research findings have highlighted several issues that can impact the effectiveness and efficiency of employee attendance processes. Through the development of a QR code-based employee attendance system for factories, the following key conclusions have been drawn. Firstly, the implementation of this Attendance application has the potential to significantly accelerate the attendance recording process for employees. Secondly, the adoption of a QR Code-based system simplifies the management and retrieval of employee attendance data and information for staff members. Lastly, the user-friendly nature of the designed Attendance system allows for easy integration and application across various companies. Overall, the use of QR codes in employee attendance management offers a promising solution to enhance efficiency and convenience in the workplace.

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