Design and development of student attendance information system using QR code in accounting department of Politeknik Negeri Semarang

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Abstract. This study aims to streamline the lecture attendance system and overcome indications of cheating on student absences in the lecture process in class. Manual attendance list causes lost time of lectures and waste of paper, and therefore the need for an attendance system to reduce these problems. Higher education with all its strategic activities cannot be separated from the importance of using information technology. One of the important activities routinely carried out by a tertiary institution is to record Academic Administration activities (teaching and learning process), this routine activity involves many interests both from the lecturers, administration and from the learning facilities and infrastructure they have. This activity must be made an information system in order to facilitate all parties and produce information that is fast and valid. One such information is student information about absence which can be caused by permission, illness or even negligence. This activity is carried out every day so that if and error occurs or negligence will harm all parties involved in the teaching and learning process therein. This article discusses how to design and build an Academic recording information system in the form of student attendance that can produce accurate and timely information available to meet the needs of students, Academic Administration and department managers so that the information system can be aligned with academic regulations and can be accepted by system users. The object used is the Semarang State Polytechnic Accounting Department. The method used is to use the Unified Model Language approach which consists of Use Case Diagrams, Class Diagrams, and Data Dictionaries. While the development model using waterfall, the stages include analysis of the existing system, concept design, physical design, implementation and testing. The output of the research is an Android-based student attendance information system application using QR Code which generates information for students, Academic Administration and department managers.

1. Introduction
Politeknik Negeri Semarang (Polines) is a vocational-based educational institution, this learning system is more focused on work or practice skills compared to theory. The lecture system can work well if the recording of student arrivals is effective and efficient. Politeknik Negeri Semarang (Polines) is currently in the midst of students still using manual recording that is students who have permission to register every student who receives lectures and lecturers record the absence of students in class at lecturer teaching hours. The student participation recording system used today is ineffective and inefficient because the opportunity for students to manipulate the release participation data still occurs and sometimes the lecturer does not record the absence of the student. Teaching and Learning Management
(PBM) also corrects the difficulty in calculating the hours of absence of students at one time that will be sent to the Student Administration section to determine whether students can get an exam, whether students get a Warning Letter 1 (SP1), Warning Letter 2 (SP2) The Semarang State Polytechnic is in accordance with the Academic Regulations (Perak) which have often been a mismatch of data in the absence of student absence between PBM data and the results of calculations in the Student Administration Section (BAAK).

Technology that continues to develop nowadays can be used to improve the quality of the systems needed in recording student attendance at the Polytechnic. One technology that can be applied is Rapid Response technology or known as QR Code. Application of this technology as practiced by Arulogun. The application of QR Code for monitoring student attendance developed and used in this study is able to eliminate time wasted during manual attendance gathering and opportunities for education administrators to capture classroom face-to-face statistics for allocation of attendance scores that are appropriate and for further managerial decisions [1]. Also implemented in Malaysia, a systematic student participation management system based on the QR Code allows many easy methods to receive meetings [2-5].

This application is expected to reduce and even eliminate the manipulation of data received by students in the Politeknik Negeri Semarang, especially Computerized Accounting Study Program and facilitate the calculation of student absence hours that are expected to be the same data in PBM as the data in BAAK. Application software development in various fields such as academic, construction, industry, etc. uses the SDLC (System Development Life Cycle) method, whereas for system development using the Use Case model, and to get improved system performance developed using the UML model with case study on Amazon.com. The development of student attendance recording systems is also carried out with this SDLC method as designed by Hanisah [2] which states "in collaboration with developing a system development cycle (SDLC), this system has been fostered using a web-based application". Supporting technology in academic support systems as outlined above is an interesting challenge to apply to overcoming difficulties in the Politeknik Negeri Semarang.

Regarding the problem discussed in this study is How to discuss Academic recording information systems that include student attendance that can produce accurate information and be available in a timely manner to meet the needs of students, PBM and department managers make information systems in line with system regulations.

2. Literature review

2.1. Waterfall system development model
Software engineering method used by researchers is the waterfall method. According to Pressman et all waterfall is a classic model that is systematic, sequential in building software [3]. Here are descriptions of the waterfall model.

Phases in the waterfall model according to the Pressman reference:

![Waterfall diagram](image)

**Figure 1.** Waterfall Pressman.

2.1.1. Communication. This step is an analysis of software requirements, and the stage for conducting data collection by meeting with customers, as well as collecting additional data both in journals, articles, and from the internet.
2.1.2. **Planning.** The planning process is a continuation of the communication process (requirements analysis). This stage will produce user requirements documents or can be said as data related to the user's wishes in making software, including plans to be carried out.

2.1.3. **Modeling.** This modeling process will translate requirements into a software design that can be estimated before coding is made. This process focuses on the design of data structures, software architecture, interface representation, and procedural details (algorithms). This stage will produce a document called software requirements.

2.1.4. **Construction.** Construction is the process of making code. Coding is the design translation in a language that can be recognized by a computer. The programmer will translate the transaction requested by the user. This stage is the actual stage in working on a software, meaning that the use of computers will be maximized in this stage. After the coding is complete it will be tested on the system that was made earlier. The purpose of testing is to find errors in the system and then it can be fixed.

2.1.5. **Deployment.** This stage can be said to be final in making a software or system. After conducting analysis, design and coding the finished system will be used by the user. Then the software that has been made must be done regularly maintenance.

2.2. **Quick Response code (QR code)**

QR Code, short for Quick Response Code, is a two-dimensional image that has the ability to store data. QR Code is commonly used to store data in the form of text, be it numeric, alphanumeric, or binary code. QR Code is widely used for commercial purposes, especially in Japan, usually containing a URL link to a particular address or just text containing advertisements, promotions and others. One that is not commonly used in QR Code is inserting images into the information that is stored.

![QR Code](image)

**Figure 2.** QR code.

3. **Research methodology**

3.1. **Research flowchart**

The research flowchart is shown in Figure 3 below:
3.2. Research stages

The research was made based on the development of the waterfall software. The stages are requirements analysis, design, implementation and testing.

3.2.1. Communication. This stage approaches and talks with the Department of Accounting to get an understanding of the use of this system.

3.2.2. Planning. At this stage the necessary data is collected as input material to create PBM activity recording applications namely course data, lecturer data, class data, room data, student data and class schedule data. The process for processing input data is with the help of RFID devices. The output produced is in accordance with what is expected.

3.2.3. Modeling. Modeling or Design consists of 3 (three) stages namely process modeling with the aim of designing data flow diagrams (DAD), entity relationship diagrams (ERD) and database tables, and designing user interfaces aimed at designing interfaces / displays of input and output systems on screen using GUI (Graphical User Interface) principles that are easily understood by system users.

3.2.4. Construction. Construction in another sense is the implementation of system design into a program module (coding program). In this process, the design will be converted into coding operations by using certain programming languages which are based on the use of genetic algorithms for the process of preparing lecture and examination schedules.

3.2.5. Testing. The testing process is carried out on internal logic to ensure all statements have been tested. Functional external testing to find errors and ensure that the input will provide the actual results.
as needed. Testing in this study took a case study of PBM Recording in the academic year 2018/2019 at the Semarang State Polytechnic Accounting Department.

3.3. PBM activity recording system
The description of the working order of the system or the system algorithm can be described simply as follows in figure 4:

![Algorithm for recording PBM activities](image)

**Figure 4.** Algorithm for recording PBM activities.

4. Results

4.1. System design

4.1.1. Use case diagram. Use Case is used to describe the interaction between an actor and a system that is built. Usecase's description as follows:
Figure 5. Use case diagram.

4.1.2. ER diagram.

Figure 6. ER diagram.

Diagram Dictionary for ER Diagram design:
### tbabsen

| Kolum   | Jenis   | Tidak Terutil | Rowrunn | Tense ke | Komentar | MIME  |
|---------|---------|---------------|---------|----------|----------|-------|
| id_absen | varchar(20) | Tidak        | 2       | 8        |          |       |
| id_jadwal | varchar(20) | Tidak        | 3       | 9        |          |       |
| id_gr    | varchar(20) | Tidak        | 4       | 10       |          |       |
| name     | varchar(20) | Tidak        | 5       | 11       |          |       |
| waktu    | timestamp  | Tidak        | 6       | CURRENT_TIMESTAMP |          |       |

### Indeks

| Nama kolum | Jenis   | Uuniq | Dippeduction | Kolum   | Konst | Tense ke | Komentar | MIME  |
|------------|---------|-------|--------------|---------|-------|----------|----------|-------|
| PRIMARY    | BTree   | Ya    |              | id_absen | 1/8   | A        |          |       |

### tbdosen

| Kolum   | Jenis   | Tidak Terutil | Rowrunn | Tense ke | Komentar | MIME  |
|---------|---------|---------------|---------|----------|----------|-------|
| nag      | varchar(20) | Tidak        | 2       | 8        |          |       |
| nama_dosen | varchar(20) | Tidak        | 3       | 9        |          |       |
| password | varchar(20) | Tidak        | 4       | 10       |          |       |

### Indeks

| Nama kolum | Jenis   | Uuniq | Dippeduction | Kolum   | Konst | Tense ke | Komentar | MIME  |
|------------|---------|-------|--------------|---------|-------|----------|----------|-------|
| PRIMARY    | BTree   | Ya    |              | nag     | 1/8   | A        |          |       |

### tbjadwal

| Kolum   | Jenis   | Tidak Terutil | Rowrunn | Tense ke | Komentar | MIME  |
|---------|---------|---------------|---------|----------|----------|-------|
| id_jadwal(Chosen) | int(20) | Tidak        | 2       | 8        |          |       |
| id_matkul | int(20) | Tidak        | 3       | 9        |          |       |
| id_jurusan | int(20) | Tidak        | 4       | 10       |          |       |
| np       | int(20) | Tidak        | 5       | 11       |          |       |
| status   | text    | Tidak        | 6       | 12       |          |       |

### Indeks

| Nama kolum | Jenis   | Uuniq | Dippeduction | Kolum   | Konst | Tense ke | Komentar | MIME  |
|------------|---------|-------|--------------|---------|-------|----------|----------|-------|
| PRIMARY    | BTree   | Ya    |              | id_jadwal | 1/8   | A        |          |       |

### tbkelas

| Kolum   | Jenis   | Tidak Terutil | Rowrunn | Tense ke | Komentar | MIME  |
|---------|---------|---------------|---------|----------|----------|-------|
| id_kelas | varchar(20) | Tidak        | 2       | 8        |          |       |
| nama_kelas | varchar(20) | Tidak        | 3       | 9        |          |       |

### Indeks

| Nama kolum | Jenis   | Uuniq | Dippeduction | Kolum   | Konst | Tense ke | Komentar | MIME  |
|------------|---------|-------|--------------|---------|-------|----------|----------|-------|
| PRIMARY    | BTree   | Ya    |              | id_kelas | 1/8   | A        |          |       |
4.2. Application

4.2.1. Admin web page. Polines Attendance Application is an application that aims to create a Smart Anti-Fraud based Solution of QR Code. Just as the name suggests, Attendance Polines function to be a substitute for a conventional attendance system that takes queuing time and costs for procuring sheets of attendance paper. After logging in via the form that appears, you will be directed automatically to the lecturer dashboard page. It is on this Lecturer page that data management is carried out.

![Figure 7. Home page.](image)

If there are no errors in the username / password that you fill in the login form, then you will automatically be directed to the Dashboard page.
4.2.2. **Student app.** After successfully logging in the application, students are then required to attend the attendance process. Click the menu in the upper left corner and select "Scan Attendance QR".
If successful in the application a message will appear that the attendance that you have done has been successfully carried out. With the success of the QR code scan, student data will be saved to a database on the server.

4.3. Test system
The system that has been successfully created needs to be tested to see whether the system's performance meets the planned specifications and further known User acceptance of the system and the need for improvement to improve the system itself.

| No | Role   | Activities                          | Checklist          |
|----|--------|-------------------------------------|--------------------|
| 1  | Admin  | Check and manage to ensure all activities run smoothly | Checklist system → System components |
| 2  | Lecturer | Check the role and function of making QR Code and report / recap of attendance | QR code generator Attendance Recap |
| 3  | Student| Scan QR code Enter absent data recorded | Scan QR code Success Report |

5. Conclusion
Making attendance systems with QR Code is done through a design that includes Usecase, ER Diagrams, Database Design and Data Dictionary. This design is based on the needs concluded from the FGD.

The results of the design are implemented into an Android-based application that is divided into 2 stakeholders, namely Lecturers and Students. Lecturers use the application to generate and display QR Codes on the screen in front of the class. Student uses an android application on their smartphones to scan the QR Code projected on the screen and send their data to the server as proof of his presence. The application has been carried out a System Test whose results indicate that in general the Application can be accepted and utilized for the implementation of the Teaching and Learning activities.

Suggested improvements are concluded from entering the implementation of the system test for future system improvements including integration with the existing Schedule Application, the provision of a Local Server that can be more stable and faster access and a more comprehensive attendance report.
for all lecturers as attendance reports and students as a recap of performance and compensation sanctions from absence.

References

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